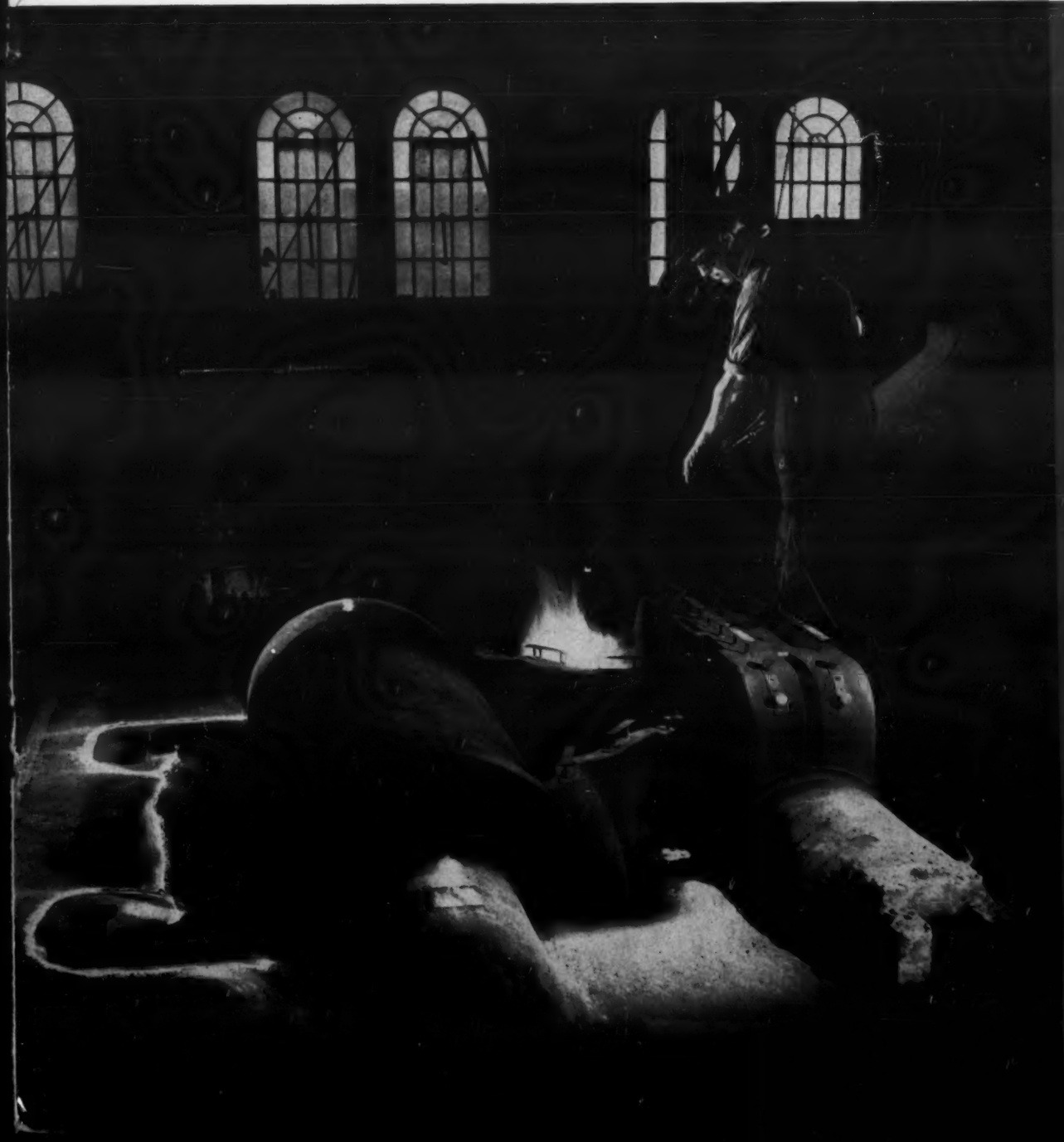
FEBRUARY, 1958

modern castings



The Foundrymen's Own Magazine

Better Equipment P. 28

Research by equipment builders is necessary to the continuing success of castings industry

Fire! P. 32

Burned-out foundry was producing castings in 40 days because of fast management action.

80% of What? P. 34

Attorney-foundryman sees flaws in co-insurance protection for metalcasting plant properties

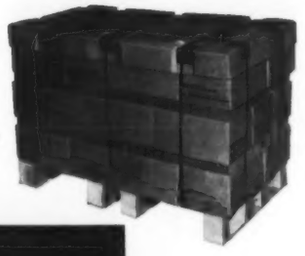
Castings for Enameling P. 35

Craftsmanship is an essential element in production of good vitreous enamelware castings

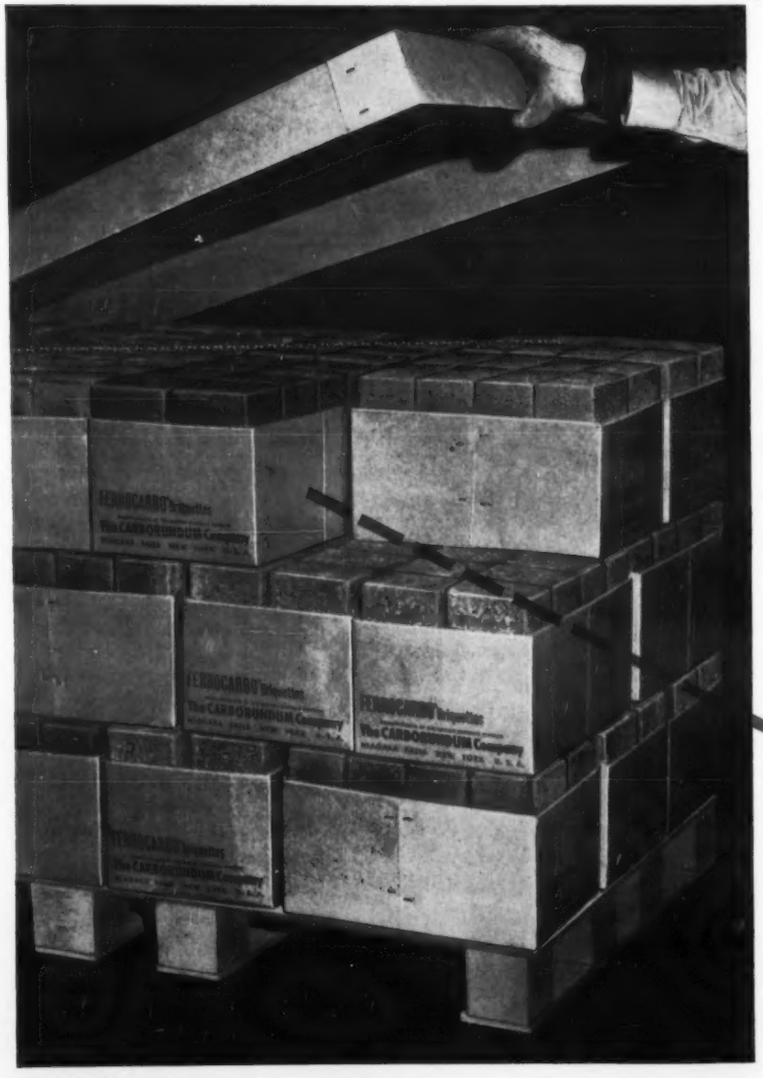
Smoke Catcher P. 83

Fume collector on arc furnace at Vancouver Steel draws smoke directly through holes in roof

new **FERROCARBO®** packaging...



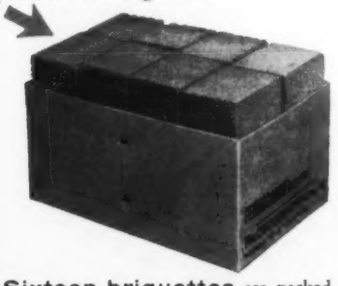
a typical pallet of FERROCARBO Briquettes showing interlocking pattern and entry feature. Lift tests prove exceptional strength up to 60 times greater than conventional packaging.



improves material handling

CARBORUNDUM, constantly alert to customers requirements, has introduced a new FERROCARBO package. This has been designed by CARBORUNDUM packaging engineers to meet its foundry customers' known problems of storage, handling and loading of the patented additive — FERROCARBO Briquettes.

Sturdy, 16-unit open top cartons, packed in an interlocking pattern, provide a lower, more compact pallet load. Greater accessibility is afforded by a 4-way entry feature, thus reducing handling time and costs to a minimum. Strong, weather-proof covers protect the pallet under outside storage conditions. Also, the complete FERROCARBO package is adequately labeled to insure immediate recognition.



Sixteen briquettes are packed in sturdy, more compact individual cartons of open top design for quick, easy loading.

FERROCARBO Briquettes by CARBORUNDUM are widely used by foundrymen to produce sound castings with required strength, ductility and hardness properties. Tests in leading foundries have demonstrated that FERROCARBO-treated iron has considerably better machining properties due to structure control and freedom from segregation.

ACTUAL CASE HISTORY INFORMATION is available on how FERROCARBO produces more machinable iron regardless of metal composition. Write for booklet A-1409, Electro Minerals Division, Department 84-82, The Carborundum Company, Niagara Falls, N. Y.

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Circle No. 321, Page 7-8

future meetings and exhibits

FEBRUARY

6-7 . . Malleable Founders' Society, *Technical & Operating Conference.* Wade Park Manor, Cleveland.

7-8 . . Non-Ferrous Founders' Society, *Management & Operating Conference.* Ambassador Hotel, Los Angeles.

10-14 . . American Society for Testing Materials, *Committee Week.* Hotel Statler, St. Louis.

13-14 . . AFS *Wisconsin Regional Foundry Conference.* Hotel Schroeder, Milwaukee.

16-20 . . American Institute of Mining, Metallurgical & Petroleum Engineers, *Annual Meeting.* Hotels Statler and Sheraton-McAlpin, New York.

18-20 . . Investment Casting Institute, *Annual Meeting.* New York.

20-21 . . AFS *Southeastern Regional Foundry Conference.* Patten Hotel, Chattanooga, Tenn.

24-25 . . AFS Board of Directors, *Annual Meeting.* Ponte Vedra Hotel, Ponte Vedra Beach, Fla.

28 . . Malleable Founders' Society, *Western Section Meeting.* Drake Hotel, Chicago.

28-March 1 . . American Society for Quality Control, *Middle Atlantic Conference.* Hotel Statler, New York.

MARCH

3-6 . . American Society of Mechanical Engineers, *International Gas Turbine Power Division Conference & Exhibit.* Shoreham Hotel, Washington, D. C.

12-13 . . Foundry Educational Foundation, *College-Industry Conference.* Statler Hotel, Cleveland.

17-18 . . Steel Founders' Society of America, *Annual Meeting.* Drake Hotel, Chicago.

17-21 . . National Association of Corrosion Engineers, *Conference & Exhibition.* Civic Auditorium, San Francisco.

APRIL

14-16 . . American Institute of Mining, Metallurgical & Petroleum Engineers, *41st National Open Hearth Steel Conference.* Statler Hotel, Cleveland.

14-18 . . American Welding Society, *Annual Meeting and 6th Welding Show.* Kiel Auditorium and Statler Hotel, St. Louis.

21-23 . . Association of Iron and Steel Engineers, *Spring Conference.* Dinkler-Tutwiler Hotel, Birmingham, Ala.

27-May 1 . . American Ceramic Society, Inc., *Annual Meeting.* Penn-Sheraton Hotel, Pittsburgh, Pa.

MAY

1-8 . . American Soicety of Tool Engineers, *26th Annual Meeting & Convention.* Convention Center, Philadelphia.

8-10 . . American Material Handling Society, *Western Material Handling Show.* Great Western Exhibit Center, Los Angeles.

12-16 . . American Society For Metals, *1st Southwestern Metal Congress & Exposition.* State Fair Park, Dallas, Texas.

19-20 . . Non-Ferrous Founders' Society, *Annual Meeting.* Carter Hotel, Cleveland.

19-23 . . American Foundrymen's Society, *62d Annual Castings Congress & Foundry Show.* Public Auditorium, Cleveland.

21-22 . . American Iron & Steel Institute, *Annual Meeting.* Waldorf-Astoria Hotel, New York.

JUNE

9-10 . . Malleable Founders' Society, *Annual Meeting.* The Homestead, Hot Springs, Virginia.

9-12 . . American Society of Mechanical Engineers, *National Materials Handling Conference.* Public Auditorium, Cleveland. *Held in conjunction with Materials Handling Exposition.*

12-13 . . AFS *15th Annual Chapter Officers Conference.* Hotel Sherman, Chicago.

19-21 . . AFS *3d Annual Foundry Instructors Seminar.* Case Institute of Technology, Cleveland.

22-28 . . American Society for Testing Materials, *61st Annual Meeting.* Hotel Statler, Boston.

SEPTEMBER

23-26 . . Association of Iron and Steel Engineers, *Annual Meeting.* Public Auditorium, Cleveland.

OCTOBER

5-8 . . National Association of Corrosion Engineers, *Annual Meeting, Northeast Regional Div.* Somerset Hotel, Boston.

8-10 . . Gray Iron Founders' Society, *Annual Meeting.* Sheraton Park Hotel, Washington, D. C.

16-18 . . Foundry Equipment Manufacturers Association, Inc., *Annual Meeting.* The Greenbrier, White Sulphur Springs, W. Va.

27-31 . . American Society for Metals, *National Metals Exposition & Congress.* Public Auditorium, Cleveland.

NOVEMBER

10-12 . . Steel Founders' Society of America, *13th Technical & Operating Conference.* Carter Hotel, Cleveland.

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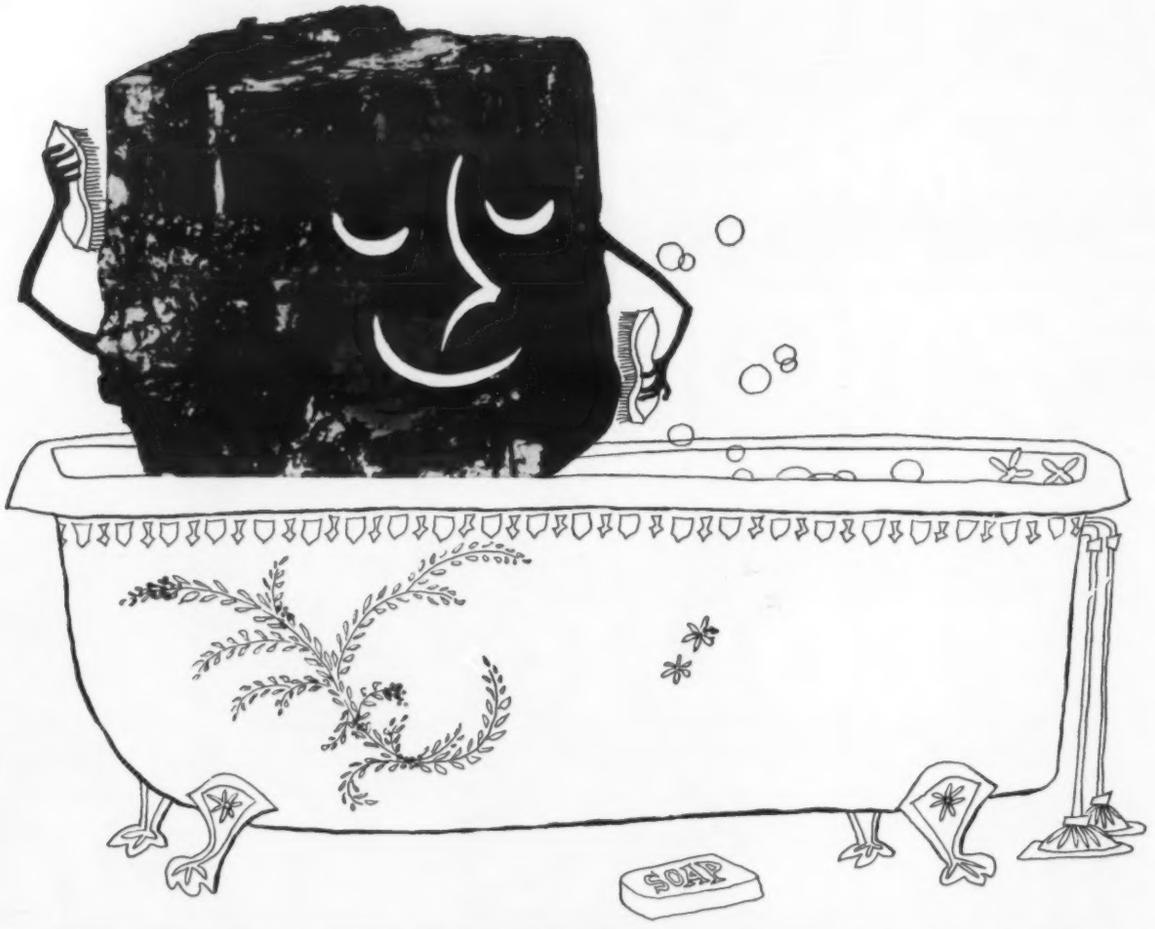
Circle No. 322, Page 7-8



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Circle No. 323, Page 7-8

Light Metal Castings are Inspected by Fluoroscope

■ It is paramount for the castings industry to discover imperfections in foundry production as soon as possible; the quicker such imperfections are located, the sooner the source of the trouble will be isolated, and the cause eliminated. Defective castings represent financial loss and many times their cost in bad will if allowed to reach the consumer.

The standard method for pin pointing casting flaws in recent years has been by use of x-rays. Chance Vought Aircraft, Inc., Dallas, Texas has recently recommended fluoroscope inspection of aluminum and magnesium castings for flaws at a saving of time and money over the x-ray method.

The high intensity fluoroscope, developed by Naval Ordnance Laboratory, White Oak, Md., was loaned to Chance Vought for a 20-month test of the machine's capabilities in detecting flaws in castings.

Some 2000 light alloy castings were examined on the fluoroscope's screen by the company's quality control department. *A number of parts found to contain flaws had already passed inspection by xray.* The company recommended fluoroscopy for all castings tested, with x-ray suggested on only a sampling basis for one class of castings.

Castings to be inspected are placed in a large plastic "bubble" and are

supported by toy balloons (photograph). The bubble with the casting enclosed can then be rotated on any axis whereas x-ray photography usually is done in two planes.

Chance Vought reports that the cost of fluoroscopy is considerably less than xray. Of four castings inspected by both methods, one cost $0.16 to inspect by fluoroscope and $0.80 by the x-ray method; a second $0.14 versus $1.20; a third $0.14 and $0.80; and the fourth $0.18 and $1.96.

february, 1958
vol. 33, no. 2

modern castings

in this issue

Does Foundry Equipment Meet Foundry Needs / F. W. Shipley..... 28
How New Equipment Meets the Needs of Gardner-Denver Foundry.. 31
Fire! / E. F. Hines 32
Co-Insurance / K. D. Love 34
Producing Castings for Vitreous Enamel / C. A. Sanders and R. E. Wilke 35
BONUS SECTION
1958 Transactions Preview
Gases in Cast Iron / J. V. Dawson and L. W. L. Smith 39
Observations on Pinhole Defects / R. W. Heine 53
Theoretical Concepts / J. B. Caine and Dr. C. E. McQuiston 58
Density of Sand Grain Fractions / R. W. Heine and T. W. Seaton 62
Improving Electric Furnace Refractory Life / V. J. Howard 68
Canadian Foundry Stifles Smoking Arc Furnace / J. R. Belyea 83

regular departments

Advance Registration Forms.. 99
Advertisers and Their Agencies 106
AFS News 71
Castings Through the Ages .. 105
Chapter Meetings 81
Classified Advertising 105
Dietrich's Corner / H. F. Dietrich 92
Editor's Field Report 20
For The Asking 92
Foundry Trade News 88
Future Meetings & Exhibits .....Inside Front Cover
Here's How 86
Industry in Action 90
Let's Get Personal 86
New Books 21
Obituaries 23
Patent Review / Melvin Nord 98
Products and Processes 6
Product Reports 17
SHAPe / H. J. Weber 24

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AUDITED PAID CIRCULATION ABC

What We Expect from Suppliers

We are all customers of someone else. Our customers are manufacturers who buy our engines for installation in equipment they sell to the retail customer. Therefore our suppliers must measure up to the same standards which our products must meet to satisfy our customers.

Our customers expect us to be a firm with integrity, financially sound, and growing in such a way as to meet their demands for a better product at a lower price. It is only natural that we expect our suppliers to measure up to this same set of values.

The first requirement we have of any supplier is that his firm be one of solid integrity; a firm that can be trusted as to its promises, its product quality, and its interest in customers' problems. We don't want a supplier that will leave us when the going gets tough. We want him to accompany us along the difficult stretches as well as the easy ones.

Next, our suppliers should make money, both on their whole business and on the business they do with us. We continue to search for the lowest possible cost, whether it be from our own manufacturing or from outside purchase. But when we purchase outside, we intend that our accounts be profitable to the supplier.

We require that our suppliers grow with us. We try to keep our suppliers informed of our expanding needs and we need their assurance that they will have the capacity to keep up with us. We want them to grow; we want to see their plans for growing.

We require our suppliers to be progressive, improving through their own research and development, availing themselves of the latest and best in new machinery and methods as they become available. We know that research is the key to successful development of our product and our company. This same research effort is expected of our suppliers.

We require that they be financially sound; that their credit be kept high; and that they be in financial position to make such growth as we and other customers may require.

Finally, we always watch carefully the attitude of our suppliers toward their employees, for they are the most valuable asset any company has. They are the ones who build the organization and company . . . not the buildings, nor the machinery. Our primary aim is that our relations with our suppliers may be long-lasting, profitable to them, economical to ourselves, and completely fair to both parties.

It seems to me that it is all one triangle. We expect of our suppliers what we want of our customers and what we hope we are to each other.

R. B. STONER / *Vice-President*
Cummins Engine Co.
Columbus, Ind.

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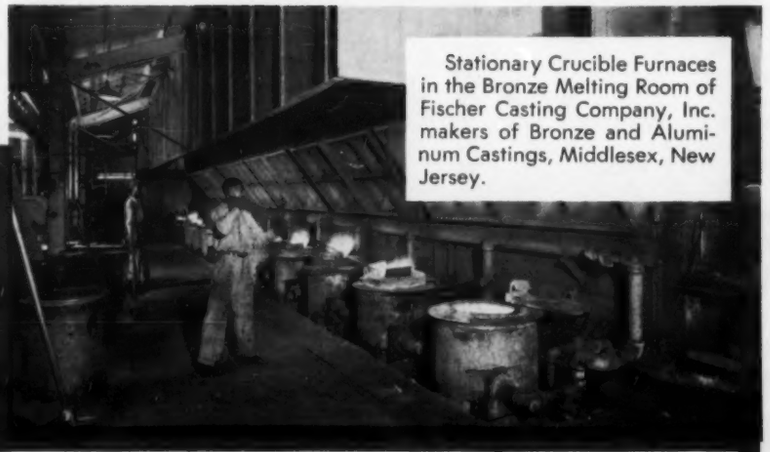
For example, take No. 8—Adaptability. Crucible Melting best meets variations in size and analyses of melts required and expansion or contraction in production.

Tilting-type Crucible furnaces in plant of Northern Pump Company at Minneapolis, Minnesota. Crucibles size No. 275; gas fuel is used with proportional mixers. Photograph courtesy of Northern Ordnance, Inc. A typical Crucible installation.



Stationary Crucible Furnaces in the Bronze Melting Room of Fischer Casting Company, Inc. makers of Bronze and Aluminum Castings, Middlesex, New Jersey.

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Circle No. 324, Page 7-8

Labor Relations Techniques Studied at N.F.A. Meeting

Highlighting the 59th Annual Meeting of the National Foundry Association held in New York in November, a management and bargaining team composed of N.F.A. members enacted a skit depicting labor relations techniques. Attendants also heard of the immediate objectives and long-range goals of the major foundry unions. In addition, they were told how to develop effective employee communications and how public opinion affects management.

New Officers

Arthur G. Hall, Nordberg Manufacturing Co., Milwaukee, was

A. G. Hall

elected N.F.A. president; R. C. S. Potter, Chemung Foundry Corp., Elmira, N. Y., was elected vice-president; and W. G. Greenlee, Greenlee Foundry Co., Chicago, was re-elected treasurer. Charles T. Sheehan was reappointed executive secretary.

Union Goals

The pre-convention program consisted of an Administrative Council executive session and an alumni banquet at which retiring council members were presented certificates of merit for their efforts in promoting the N.F.A. and the industry as a whole. In addition, honorary membership plaques were presented to Thomas W. Pangborn, Pangborn Corp., Hagerstown, Md., and Frank Steinebach, Penton Publishing Co., Cleveland, for their outstanding contributions to the advancement of the foundry industry by careers of dedicated service.

Keynote speaker James I. Poole,

labor law attorney, Milwaukee, spelled out the anticipated demand of the Molders, Steelworkers and Auto Workers unions during 1958 in foundry labor negotiations. He also outlined what he felt to be the long-range goals of these major foundry unions. Prime targets will be higher wages, shorter hours, better fringes, and short-term contracts. Poole foresees industry-wide bargaining among foundries unless precluded by legislation or a strong employer reaction not apparent.

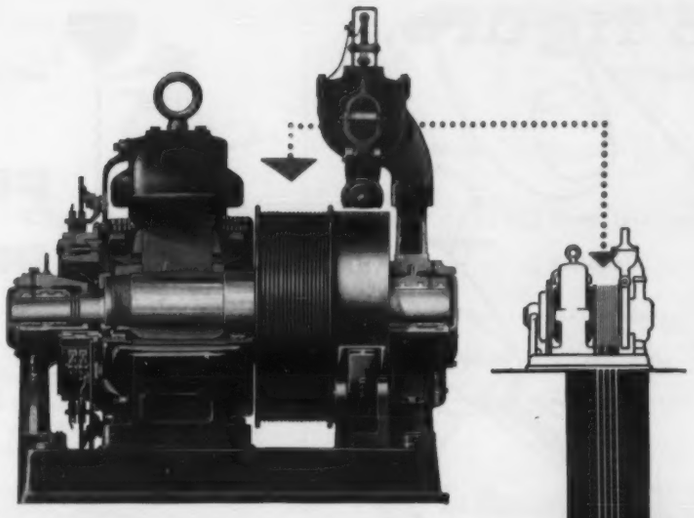
Speaking on the development of effective employee communications, Dr. Paul J. Mundie, a consulting psychologist from Milwaukee, stated that one of the falacies in industrial communication is that employers want to receive as much as they give. Dr. Mundie declared that companies seeking this equation in industrial communication will fail in establishing communication as an effective technique in labor relations.

Labor Relations Skit

Seven N.F.A. members presented a skit on labor relations. The skit began with a preliminary discussion between the company president, his staff, and company attorney on weaknesses in the present labor agreement and areas which must be improved. The staff then reported back to the president on revisions of the agreement reflecting company proposals.

The bargaining team then reported to the president on proposals exchanged between the company and union. The team dwelled on techniques used, the position of the union, and the demands which appeared to be "real" demands. A second meeting with the union included statements of the union, demands the union had withdrawn, techniques used, charges, countercharges, and threats made. The company position was further defined and plans for alternative possibilities developed, including company preparation for a possible strike.

The 59th Annual Meeting was closed at a luncheon, Dilman M. K. Smith, Opinion Research Corp., Princeton, N. J., speaking. It was announced that the site of the 60th Annual Meeting will be the Drake Hotel, Chicago, to be held late in November, 1958.



Otis Elevators Use HANNA PIG IRON

to support their ups and downs

Rough finishing a one-piece sheave rim and brake pulley casting in the Otis Elevator Company's Yonkers foundry.

Center of action in the mechanism of Otis Elevator Company's high-speed (up to 1,400 ft. per minute) Autotronic passenger elevators is the one-piece cast iron drum shown in place in the top picture and in rough form below. Half of the drum serves as a sheave rim for the elevator's cables, the other half as a brake pulley. To maintain the high standards of quality and performance demanded of these drums, Otis Elevator's foundry at Yonkers, N. Y., casts them with Hanna Pig Iron.

The Hanna range includes the Hanna 38-pound pig, the foundryman's favorite standard, in all grades, silvery and HannaTite, a specially controlled, close-grain iron. Also available is the HannaTen, a smaller ingot, with finer grain structure and no free carbon pockets. For prompt, expert handling of your pig iron requirements, call your Hanna representative at any time.

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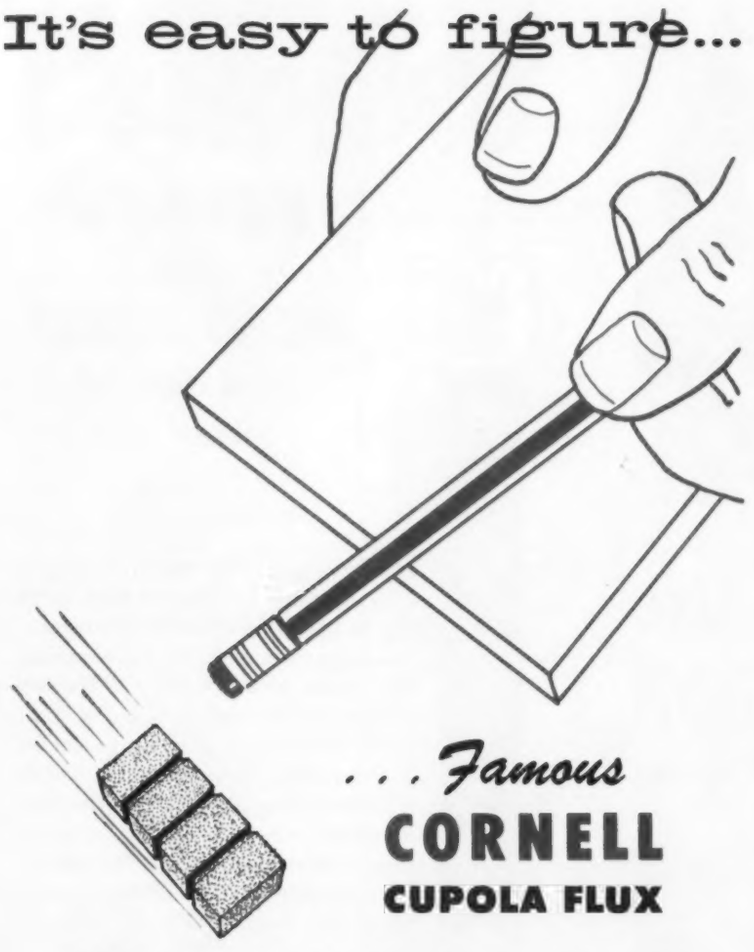
Circle No. 325, Page 7-8

It's easy to figure...



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Circle No. 326, Page 7-8

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products and processes

FLUORESCENT INSPECTION . . . kit locates cracks, pores, and leaks in non-magnetic materials. Portable penetrant inspection kit includes pressurized spray cans of cleaner, penetrant, and developer, plus a high intensity black light used to locate imperfections in castings. *Magnaflux Corp.*

For Manufacturer's Information Circle No. 201, Page 7-8

EPOXY RADIATION SHIELD . . . lead-filled casting material designed to provide an effective shield against x-rays and radioactive emissions. Process said to employ inexpensive molds and simple casting techniques. Applications are instrument housings, pipe and valve fittings, and containers. *Marblette Corp.*

For Manufacturer's Information Circle No. 202, Page 7-8

CO_2 VACUUM CHAMBER . . . gassing machine with operating cycle of 20-30 sec is said to produce higher and more consistent physical properties than hand gassing while using less gas and eliminating gassing heads or venting.

Unit cures uniformly including the edges, corners and deep blind recesses. Core can be cured in the box, on driers, or stripped with equal facility. Can cure chamber filled with a number of cores on the same machine-cycle time as individual cores while the hollowing out of large cores presents no gassing problems.

The treatment chamber (measuring 12x23x24 in.) is evacuated and pressured with CO_2 automatically through two cycles as follows: first vacuum 3-10 sec; first pressure, 2-5 sec; second vacuum, 3-10 sec; dwell pressure, 10-30 sec.

Wooden blank-off blocks are used in cage to decrease the volume to be evacuated and pressurized.

In mold production the gasser produces hard surfaces next to the pattern without vents or rigging. Overgassed hardnesses are economical since the CO_2 is not dissipated during longer curing interval. *Alphaco, Inc.*

For Manufacturer's Information Circle No. 203, Page 7-8

METALLIC FIRES . . . extinguished by shoveling or pouring material directly on combustible metal. Extinguishes burning magnesium, calcium, sodium, potassium, and other metals. Also useful as a packing material to prevent fires, and used as an additive to zirconium scrap piles to prevent spontaneous combustion. *Mercantile Metals, Inc.*

For Manufacturer's Information Circle No. 204, Page 7-8

ELECTRIC FURNACE . . . bench-type, said to leave substantial power reserve for heavy load requirements, fast heating, and quick recovery time by consuming power only 35 per cent of the time. Top temperature limits of 2000 or 2300 F. For safety, power to elements automatically cut off when door opens. Heating chamber 10 x 9½ x 22 in. *Thermo Electric Mfg. Co.*

For Manufacturer's Information Circle No. 205, Page 7-8

FLOOR COVERING . . . said to withstand normal foot traffic within 12 hours of application, and steel wheel trucking within 24 hours. Manufacturer claims that, wet or dry, the

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and there are no well-informed
foundrymen
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Company _____

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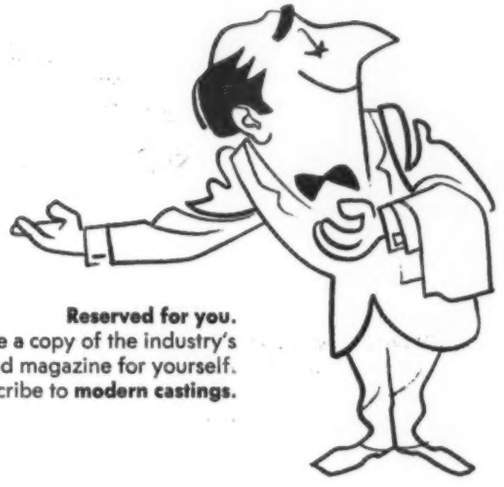


Reserved for you.
Reserve a copy of the industry's best-read magazine for yourself. Subscribe to **modern castings.**

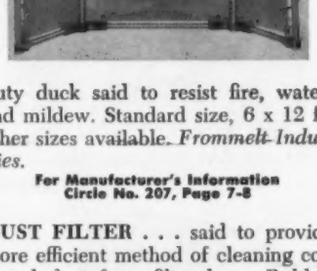
Don't be left out in the cold.
Use these cards to get the full, inside story. Circle the numbers to learn about machines and materials described in ads and in the new products and literature columns. Circle letters to receive materials mentioned in feature and special articles.

■ **Details on these products and processes are available to MODERN CASTINGS readers. See page 7-8.**

surface remains slip-proof. The material is troweled on (as it comes) over concrete, wood, steel, tile, and glass. Durable material is oil and grease resistant according to manufacturer. *Monroe Co.*

For Manufacturer's Information Circle No. 206, Page 7-8

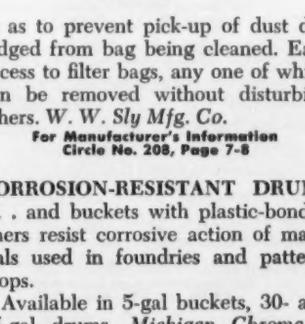
FIREPROOF SCREEN . . . for welding produced in kit form. Designed to be assembled in minutes using your own ½-in. pipe. Screen hinged to allow folding around work. Heavy-



duty duck said to resist fire, water, and mildew. Standard size, 6 x 12 ft, other sizes available. *Frommelt Industries.*

For Manufacturer's Information Circle No. 207, Page 7-8

DUST FILTER . . . said to provide more efficient method of cleaning collected dust from filter bags. Rubber rollers seal each bag after cleaning



so as to prevent pick-up of dust dislodged from bag being cleaned. Easy access to filter bags, any one of which can be removed without disturbing others. *W. W. Sly Mfg. Co.*

For Manufacturer's Information Circle No. 208, Page 7-8

CORROSION-RESISTANT DRUMS . . . and buckets with plastic-bonded liners resist corrosive action of materials used in foundries and patternshops.

Available in 5-gal buckets, 30- and 55-gal drums. *Michigan Chrome & Chemical Co.*

For Manufacturer's Information Circle No. 209, Page 7-8

PLASTIC SEALING . . . of mold parting lines said to prevent "fins" and metal "run outs." Compound is applied

COVER GREATER SURFACE AREA
...AND GET
SMOOTHER...
CLEANER CASTINGS...at lower cost!

WITH
DELTA
SUPERKOAT WASH
FOR ALL TYPES OF METALS

Delta SuperKoat Wash is recommended for Steel, Gray Iron, Malleable and Non-Ferrous castings. It's easy to mix and apply uniformly to green or dry sand and baked core surfaces by dipping, swabbing, spraying or brushing.

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

NOTE THESE IMPORTANT ADVANTAGES OF DELTA SUPERKOAT WASH:

1. NO PRECIPITATION OR SETTLING — When thoroughly mixed, wash will stay in suspension indefinitely.
2. EASY TO APPLY — It can be dipped, swabbed, brushed or sprayed on green or dry sand and baked surfaces.
3. RAPID, DEEP PENETRATION & EXCELLENT ADHESION — Quickly anchors itself 5 to 7 grains deep in sand surfaces.
4. NON-REACTIVE — LOW GAS — Will not react or produce gas in contact with molten metal.
5. REDUCED CLEANING COSTS — Cast surfaces are smoother and castings are cleaner.
6. WILL NOT FLAKE — When completely dried, the wash is thoroughly bonded to the sand surfaces.
7. HIGHLY REFRACTORY — Has an unusually high fusion point.
8. ELIMINATES SAND FUSION AND BURN-ON — Flowing metal will not crack or rupture wash during pouring.
9. ECONOMICAL TO USE — Covers a greater surface area at a lower cost per pound of wash.

DELTA

DELTA OIL PRODUCTS CORP.
MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

MILWAUKEE 9, WISCONSIN

Circle No. 327, Page 7-8

PAYLOADER®

PURCHASE AND HOUGH LEASE PLANS

"... is a double-duty work horse ..."

Ludlow Valve Mfg. Co., Inc., Troy, N. Y. is a pioneer in gate valve manufacture for nearly a century. It has its own iron, bronze and steel foundries in which it uses two "PAYLOADER" tractor-shovels to speed its sand and coke handling operations. Master Mechanic Mr. Windover calls their 3 year-old roll-back model HA "PAYLOADER" "a double-duty work horse ...standing up under a 16-hour day with normal maintenance and annual check-ups. The most trouble-free machine I ever had on the job."

The model HA has a payload capacity of 18 cu. ft. — the largest capacity of any tractor-shovel in its size range — can negotiate corners and narrow aisles where others can't operate. It features 40° bucket roll-back at ground level, one-lever bucket control, torque-converter drive. Hydraulic load-shock-absorber, an exclusive standard feature, cushions the loaded bucket reducing jounce and bounce and permitting higher load-carrying speeds with less materials spillage.

Your Hough Distributor will gladly demonstrate the new model HA or larger model HAH. Ask him about Hough Purchase and Lease Plans too.

THE FRANK G. HOUGH CO.
711 Sunnyside Ave., Libertyville, Ill.

- ☐ Model HA (2,000 lb. carry cap.)
- ☐ Model HAH (3,000 lb. carry cap.)
- ☐ Larger models (to 9,000 lb. carry cap.)

Name.....
Title.....
Company.....
Street.....
City.....State.....
2-A-2

SAY "HUFF"

Modern Materials Handling Equipment
THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

in form of gaskets which are laid on parting lines. Manufacturer claims material will not cause lumps in returned sand, and will not dry out before use. *Thiem Products, Inc.*
For Manufacturer's Information Circle No. 210, Page 7-8

CASTING RESIN . . . may be cast at least 12 in. thick without excessive exothermic heat being generated, manufacturer claims. Cast patterns and shapes reach full strength in 24-28 hours, have compressive strength of 5000 psi, and are said to be easily machined. *Furane Plastics, Inc.*
For Manufacturer's Information Circle No. 211, Page 7-8

PRECISION OPTICAL UNIT . . . combines microscope, projector, comparator, and camera into one portable unit. Projected images are instantly photo recorded, speeding research and quality control. Designed for comparison of materials, side by side, on screen large enough to allow inspection by several people at one time. *Alfred Hofman & Co.*
For Manufacturer's Information Circle No. 212, Page 7-8

HARD SURFACE WELDING . . . for portable semi-automatic surfacing of castings. Welding unit equipped

with wire feeder said to facilitate quick set-up and wire change-over, allowing more time for welding. Welding unit weighs 70 lb. *Alloy Rods Co.*
For Manufacturer's Information Circle No. 213, Page 7-8

FLAME CUTTING . . . and scarfing powder introduced into oxygen stream increases the flame temperature allowing cutting of heavier castings and oxidation-resistant metals such as iron, high-temperature alloy steels, and copper. Removes burnt cores, sand inclusions, fins, gates and risers with ease. Cuts reinforced concrete, fire brick. *Hoeganneas Sponge Iron Corp.*
For Manufacturer's Information Circle No. 214, Pages 7-8

MAGNETIC HOLDER . . . permanent magnet device said to exert powerful hold on iron or steel plates,

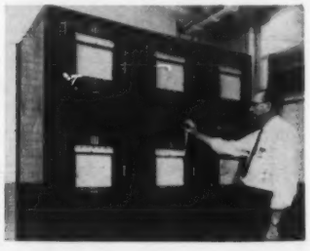
Circle No. 328, Page 7-8

■ Details on these products and processes are available to MODERN CASTINGS readers. See page 7-8.

bars, or tubes during welding or cleaning operations. Magnetic flux controlled by turning handle similar to water tap. The portable unit is independent of electricity in its operation. *Aronson Machine Co.*

For Manufacturer's Information Circle No. 215, Page 7-8

AUTOMATIC LOAD CONTROL . . . for electric furnaces reduces peak demand without reducing steel production. Automatically regulates furnaces which are melting without disturbing



final operations in other furnace. One company using control estimates savings at 20,000 kw, or about $30,000 per month. *Leeds & Northrup Co.*

For Manufacturer's Information Circle No. 216, Page 7-8

BAND-SAW GUIDE . . . places thrust wheel so back of blade rides on outside perimeter of wheel rather than along side of wheel. Said to be 166 per cent more efficient. This radial application permits use of smaller bearing which can be operated at higher speeds and take heavier thrust load.

Said to work equally well on heavy and light loads and handle thrust loads to 175 lb at maximum speeds, to 500 lb at lower speeds. Can be adapted to practically any band saw. *Carter Products Co.*

For Manufacturer's Information Circle No. 217, Page 7-8

PORTABLE BRINELL HARDNESS TESTER . . . has chain adapter to lock it securely on castings regardless of shape or size. Clear, accurate Brinell impressions are quickly obtained. Portability of the tester makes it useful in testing large castings. *King Tester Corp.*

For Manufacturer's Information Circle No. 218, Page 7-8

SHELL MOLD . . . and core machines feature multiple station indexing available with 2, 4, 5 or 6 stations. Uniform density and controlled shell thickness and accuracy are claimed for airstream blowing method. Rapid and continuous production results from automatic preset time cycles.

No back-up of castings at shake-out stations now! Excellent collapsibility of cores is one of the many advantages provided by Dexocor.

A soluble dry powder, Dexocor is easy to weigh and mix, assures high green strength, cores withstand necessary handling.

Finished cores made with Dexocor are baked in up to one-third less time, stand up against hot metal during pouring.

Circle No. 329, Page 7-8

"Truly phenomenal collapsibility" OF CORES CREDITED TO DEXOCOR® BINDER

Leading non-ferrous foundry finds this revolutionary new binder brings about many other improvements—from mulling to shake-out.

Plagued by back-up of castings at shake-out stations, this 5 tons-per-day aluminum foundry sought means of improving collapsibility of cores—and found it, in the amazing new *dry binder*, DEXOCOR.

But that was not all they discovered. Reports the superintendent:

"In addition to truly phenomenal collapsibility, DEXOCOR is easy to weigh and mix, provides excellent green strength, and both blown and rammed cores slide readily from boxes. With DEXOCOR, baking time is reduced 30 to 35%, cores stand up perfectly against hot metal—no cracking, no metal penetration, less gas and smoke—and we save 30% on cereal content of core sand mixes."

Used with Mogul or Kordek binder, DEXOCOR dry binder can improve the characteristics and performance of any core sand mix. For more information, and assistance in improving *your* operation, contact our nearest sales office, or write to:

CORN PRODUCTS SALES COMPANY
17 Battery Place, New York 4, N.Y.

Corn Products also makes MOGUL® *and* KORDEK® *binders and* GLOBE® *dextrines for the Foundry Industry.*

Fast stripping with shell removal and transfer features are aid to productivity and efficiency. Multiple oven stations allow controlled cure time at high production. *Osborn Mfg. Co.*

For Manufacturer's Information Circle No. 219, Page 7-8

POROUS SNAG WHEEL . . . dissipates heat produced in grinding operations to lessen possibility of burning castings. Wheel cooled in use by particles, which break away, forming "air conditioned" voids in cutting surface. *Electro Refractories & Abrasives Corp.*

For Manufacturer's Information Circle No. 220, Page 7-8

VACUUM INDUCTION FURNACE . . . with capacities from 50 to 300 lb has flanged mold well adjustable to depth of 48 in. Readily interchanged with bolt-on accessories. Table accommodates 42-in. molds. *Rochester Div., Consolidated Electrodynamics Corp.*

For Manufacturer's Information Circle No. 221, Page 7-8

TRANSMISSION BELT . . . does not stretch as result of new manufacturing technique. Loop built belt is available from 4 to 6 in. wide and 45 ft long. *B. F. Goodrich Industrial Products Co.*

For Manufacturer's Information Circle No. 222, Page 7-8

LABORATORY FURNACE . . . for high temperature experimental and development work up to 4500 F. Self-

contained unit includes furnace and electric power supply.

Water cooled terminals are equipped with safety control indicating when the water supply fails. *Harry W. Dietert Co.*

For Manufacturer's Information Circle No. 223, Page 7-8

CONTAINER HEATING ELEMENT . . . fits around outside of straight side 5-gal containers, heats or melts waxes, resins, adhesives and non-vola-

Minerals International Chemicals

A REPORT TO FOUNDRIES

What makes you think you are getting the most for your money?

With freight rates increasing continually, the foundryman becomes more aware that his delivered cost of Bondclay or sand binders is the important cost. There might have been an excuse once for buying materials diluted with sand or water or some other cheap material. Today, however, the cost of transporting impurities is frequently greater than the cost of the material itself.

If this sounds like beating around the bush, consider the fire clay type binders such as Revivo Bond. The same situation would exist for fireclay itself since fireclay is essentially a lower swelling binder.

The word fireclay, unfortunately, is not specific as a descriptive word. Fireclay can represent anything from a strong molding sand up to the maximum purity as represented by Revivo. The following table shows 10 different "fireclays" from a low of 29.2% clay to a high of 75.2% clay.

PRODUCT				
Revivo Bond	5.0	19.8	75.2	7.36
Eastern Ohio A	19.2	38.8	42.0	5.09
Eastern Ohio B	15.2	21.6	63.2	5.63
Northeastern Ohio	24.2	40.6	35.2	4.05
Southern Ohio	11.4	21.8	66.8	5.72
Western Penn.	36.0	38.2	35.8	4.50
West Virginia	42.4	28.4	29.2	3.39
Northern Illinois	22.0	35.2	42.8	3.82
Southern Indiana	9.2	40.8	50.0	5.42
Kentucky	11.8	43.4	44.8	4.41

The percentages in this table for sand, silt and clay cannot be used as specifications because there are variations in any naturally occurring product.

If a fireclay bond is composed of clay, silt, and sand, doesn't it make sense to buy pure clay, the strongest you can get, and introduce your sand and silt from some cheaper, lower freight source?

Usually the difference in delivered costs is sufficient to demonstrate the value of a dependable steady source such as Revivo. There are also some technical reasons for using pure clays. Many foundries have found a distinct difference in the scabbing tendencies of sands using pure clays such as Revivo as compared with sands using less pure clays. The impurities in the clay tend to stay in the sand and eventually build up to undesirable proportions. The more impurities there are, the more chances there are of introducing organic materials which completely change the expansion and refractory characteristics. Actually, fireclays or fireclay bonds may be as low as 2400°F. for the refractoriness rather than being around 3000° as in the case of Revivo Bond. The lower sintering temperatures in these materials can have quite an effect, particularly for the producer of heavy iron or steel castings.

Take a look sometime at the ASTM standards on fireclays. You probably will be surprised to find such a wide variety of materials sold under the same name. This is not because anyone is misrepresenting; the word "fireclay" is actually not a more accurate description than the words "steel" or "grey iron." A customer, for example, will send in blueprints for the castings they want and specify "grey iron." You could ship them anything from 10,000 pounds up to 70,000 pounds tensile. For some uses, the 10,000 pounds tensile might be adequate but we claim that in the case of fireclay, where a good part or most of your cost is in the freight rate, it is cheaper to buy the best you can obtain.

Circle No. 330, Page 7-8

CORE PASTE QUIZ

Core paste may be a very insignificant or minor item in the overall purchases made by a foundry. However, to the man using the paste, it is a major factor.

__Does it mix smoothly and quickly with water?

__Is it gummy?

__Can it be applied by spraying, brushing, or dipping?

__Does it develop strength by either air drying or oven drying?

__Does it creep or seep from pasted joints?

__Does it expand or contract appreciably on drying?

__How strong is the paste?

__Is it sensitive to temperature?

__Is it stable in contact with molten metal?

Try this check list on your present core paste and then let us send you a sample of Revivo Core Paste.

Check the Revivo Core Paste against the same check list, compare the cost, and we will stand or fall on your decision.

Your Eastern Clay District Sales Manager is a technical expert, as so many of you know from experience. He knows foundry operating problems and how our products can improve efficiencies and cut costs.

You in the central area who work with Bill Adams may wonder how it is that he seems to be so familiar with foundry operations. Here's why.

For a young man, Bill is an old foundry hand. Except for war-time service as a 1st Lieutenant of Infantry in the Philippines, Bill worked with Albion Malleable Iron Company in Albion, Michigan from 1939 until he joined Eastern Clay in 1952 as a sales and service engineer.

He worked at Albion in the sand and metallurgical laboratory and on refractory repair of furnaces and cupolas while at Albion College.

Albion Malleable grabbed him when he got out of the army and put him in the office on accounting, methods, industrial engineering and sales work. He also made general surveys involving annealing and cleaning methods.

Then, as Bill says, he really went to work—in the shop as a cupola operator. He became furnace operator and then melting foreman. Later he was made mold foreman, molding line foreman, annealing foreman and eventually moved back to melting as general foreman.

We at IMCC are proud of our sales staff, of our men, such as Bill Adams, who know foundry operations from long, practical experience and for that reason can be so helpful to foundrymen who depend on them for IMC materials and equipment.

The NEW CUPOLINOR

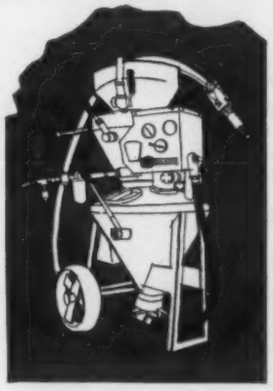
When we introduced the idea of gun patching nearly 10 years ago, we didn't realize how extensive the practice would become. At the 1948 convention in Cleveland, the new Bondactor was the hit of the show because it was a brand new conception. Today, it is run of mill but there are exciting new developments well worth reporting to you.

In literally hundreds of foundries, nothing is considered superior to a Bondactor machine. Yet, today, we have a machine that is even better; we call it the Cupolinor 1500. It is more than just a "deluxe" gun for the long run or multiple installation foundry. It is faster, more durable and simpler and easier to run.

The basic, successful principles of the Bondactor remain unchanged. However, mechanically, the machine has been literally turned upside down, enlarged and structurally strengthened. Most of the manual operations have been combined mechanically for automatic performance. As a result, the operation is simplified and streamlined.

If you think the 1958 automobile is an improvement over a 1948 automobile, you should see the improvement that we have made in refractory guns in the same length of time. We are proud to be the first to bring you a refractory gun and we are proud to offer you now the modernization and know-how based on 10 years of experience with hundreds of machines operating in hundreds of foundries.

Would you like a copy of our bulletin "Patching with Cupolinor"?



Mission Accomplished

We were talking the other day about the rapidly increasing use of Plasti-Bond and its many interesting and sometimes unique applications in almost every kind of foundry.

A foundry specializing in heavy grey iron castings of a scabbing design desired to 1) reduce casting weight, 2) reduce number of sands, 3) reduce or eliminate skin-drying and baked molds. The sand fineness was changed from 53 AGF to 68 AGF with Black Hills Bentonite, Maplex, and Plasti-Bond. The mission was accomplished quickly.

DURA PRODUCTS

It is surprising how many people put up with sand blowing in their face from the core blowers when the use of Durastrip or Durarod would not only eliminate this blow-by, but reduce costs. Every time the sand blows out at the parting line of the core box used on a core blower, there is excessive wear. No metal can withstand this abrasion. The only complete cure is to eliminate it before it starts and the best way to do that is with Durarod or Durastrip. Get the story in our booklet, "If You Operate a Core Blower."

MINERALS International CHEMICALS

EASTERN CLAY PRODUCTS DEPT.
INTERNATIONAL MINERALS & CHEMICAL CORPORATION
20 NORTH WACKER DRIVE, CHICAGO 6 • PHONE: Financial 6-1800

Circle No. 330, Page 7-8

■ **Details on these products and processes are available to MODERN CASTINGS readers. See page 7-8.**

tile chemicals. Low watt density prevents burning of materials having a slow heat acceptance factor. *Acra Electric Corp.*

For Manufacturer's Information Circle No. 224, Page 7-8

CONTOUR POLISHING . . . discs and pads utilize mushroom shape to get into contours difficult for conven-

tional types. Swirl marks said to be eliminated, requiring much less finishing. Pads are five and eight in. dia. *Behr-Manning Co.*

For Manufacturer's Information Circle No. 225, Page 7-8

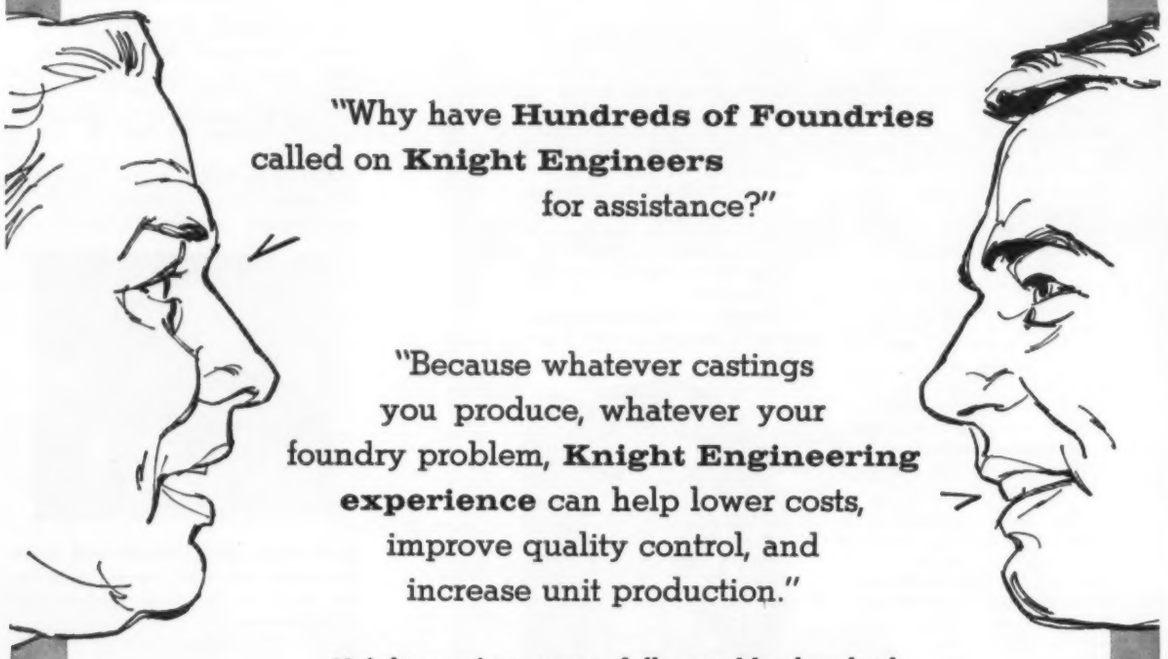
SIEVE SHAKER . . . said to give accurate sieve analyses of all types of materials formerly separated on larger, heavier, and more costly shakers.

Shaker motion and tapping action

separates and assures fast flow of materials which are being analyzed through sieve meshes. Seive shaker available in 8 or 12 in. dia. sieves. *Soiltest, Inc.*

For Manufacturer's Information Circle No. 226, Page 7-8

MOLDING MACHINE . . . compresses sand against pattern by applying air pressure to flexible rubber diaphragm which follows contours of pattern plate. Diaform pressure molding machine eliminates jolting, peening, ramming, tucking, and butting.



"Why have **Hundreds of Foundries** called on **Knight Engineers** for assistance?"

"Because whatever castings you produce, whatever your foundry problem, **Knight Engineering experience** can help lower costs, improve quality control, and increase unit production."

Knight services successfully used by hundreds of foundries of every type include:

Foundry Engineering	Flexible Budgeting
Architectural Engineering	Production Control
Construction Management	Foundry Mechanization
Foundry Organization	Foundry Modernization
Foundry Management	Foundry Methods
Industrial Engineering	Materials Handling
Wage Incentives	Automation
Cost Control	Survey of Facilities
Standard Costs	Personnel Training

Marketing

For further information on the broad background and experience of the Knight organization in the foundry field write for Bulletin 101.

EVIDENCE OF EXPERIENCE

Lester B. Knight & Associates, Inc.

Management, Industrial and Architectural Engineers

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Circle No. 331, Page 7-8

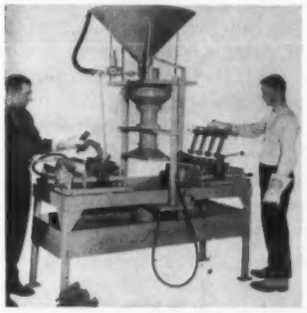
Mold hardness is consistent and uniform. Molding pressure is controllable to any level up to the maximum of the air pressure available in foundry. *Eastern Clay Products Dept., International Minerals & Chemical Corp.*

For Manufacturer's Information Circle No. 227, Page 7-8

PATTERN PANELS . . . of industrial laminate said to offer strength and durability to pattern making industry. Lignin-resin material has high dimensional stability, high density, weighs half as much as Al, and has uniform hardness. Can be shaped, drilled, sanded, beveled, and laminated to any thickness. *Masonite Corp.*

For Manufacturer's Information Circle No. 228, Page 7-8

HOLLOW SHELL CORE BLOWER . . . designed to give operator control over blow time required to fill each mold of two-station machine. Features two valves, one to operate lift table to seal the box to the sand



carrier and close self-feeder; the other to operate the blow head. Capacity, core boxes up to 4x10x15 in.; output of finished cores, 60 per hour on each side.

Said to eliminate need for core ovens, dryers, plates, core racks, reinforcing wire, and handling time. *Harrison Machine Co.*

For Manufacturer's Information Circle No. 229, Page 7-8

CO_2 SHELL MOLDS . . . for semi-precision casting technique are suitable for most metals. Combines close-tolerance aspects of shell molding with time, labor, and equipment saving features of CO_2 process. Little investment needed to use new process which requires only a CO_2 gas supply, gassing heads, inexpensive sodium silicate binder and patterns.

Gassing with CO_2 hardens mold in 15-30 sec compared to 40-75 sec for shell molds. Operations are carried out at room temperature allowing use of wood, aluminum or plastic patterns. *National Cylinder Gas Co.*

For Manufacturer's Information Circle No. 230, Page 7-8

Circle No. 332, Page 7-8

AT YOUR SERVICE

The strategic location of our manufacturing facilities, sales offices and warehouses, assures efficient handling of your ferro-alloy needs.

PLANTS: Philo, Ohio; Brilliant, Ohio and Tacoma, Washington. SALES OFFICES: Birmingham, Chicago, Detroit, Los Angeles, Philadelphia, Pittsburgh, San Francisco, Seattle. WAREHOUSES: Denver, Los Angeles, Minneapolis, Oakland, Salt Lake City, Mexico City and Vancouver, B. C., Canada. *We invite your inquiry.*

Ohio Ferro-Alloys Corporation
Canton, Ohio

For the finest in Mechanization

Jeffrey's **UNIVERSAL MOLD CONVEYOR** is Flexible

Molds move on the level, up, down and around on the Jeffrey Universal Mold Conveyor . . . full operations at elevations to best suit each job. It's working in many foundries around the country, helping to boost their earnings.

Operation is smooth; power consumption is low; equipped with sealed-for-life ball bearings and oil-impregnated bushings; internal takeup on each car.

All moving parts are shielded, giving full protection against sand, shot and runout. Rugged construction gives strength to spare for the toughest jobs.

MORE FACTS:

New Catalog 911 tells about this and other Jeffrey foundry equipment. For a copy, write The Jeffrey Manufacturing Company, 977 N. Fourth Street, Columbus 16, Ohio.

MECHANIZE with Jeffrey machinery and save. Your materials-handling and power transmission equipment will give more efficient, economical operation if you employ time-tested, dependable Jeffrey products.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT . . . TRANSMISSION MACHINERY . . . CONTRACT MANUFACTURING

Circle No. 333, Page 7-8

product reports

CONVEYOR BELT IDLER . . . used on conveying line of American Motors Corp., Kenosha, Wis., for transporting large quantities of molding sand from the line to salvage points has practically eliminated a serious maintenance problem.

The Limberoller Idler, developed by Joy Manufacturing Company of Pittsburgh, Pa., is a flexible, single roll, belt conveyor idler suspended from two bearings (one at either end) to form a natural catenary. Suspended freely from these two points, the Limberoller Idler forms its own trough and turns on its own axis. In short, it provides a simple and efficient troughing support for a conveyor belt.

Previous to installation of the new system, highly abrasive mold sand, spilling off the belt, lodged in the

steel troughing idlers which supported the belt and its load.

When this sand worked its way into the bearings on the steel idlers, the rollers froze. The belt, moving across the stopped idler roll, would then wear through the steel surface of the idler, creating a sharp, knife-like edge. Often the idler would freeze and the belt be cut before any preventive maintenance could take place. It wasn't long before the belt was cut so badly that it had to be repaired or frequently discarded.

In the two years since the first installation of this system, there has not been a single bearing failure. According to a company official, the new idlers "are practically indestructible."

The American Motors foundry has at present four belts totaling 530 feet operating in conjunction with approximately 240 of the new idlers. In addition, the plant's 320-foot-long refuse belt is in the process of being

Continued on page 19

Circle No. 334, Page 7-8

ADCOSIL

BEST FOR CO_2 CORES...

An exclusive feature in ADCOSIL is a color indicator that tells when to stop gassing a CO_2 core. The core mix is tinted a royal purple . . . then fades to a natural sand color when the core is cured throughout.

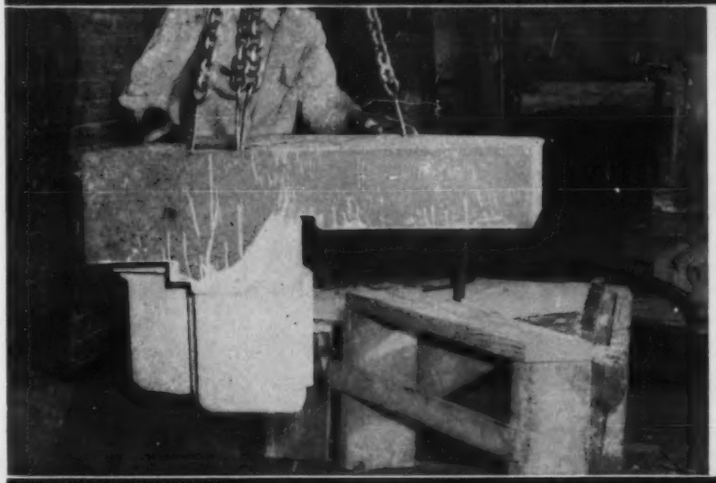
ADCOSIL helps determine where to place core vents and how many to use; helps rig new boxes and patterns; prevents under-gassing, over-gassing; encourages cores designed for most efficient flow of gas; cuts time and costs; saves gas.

Flowability, workability, core hardness, and long bench life are inherent in ADCOSIL sand mixtures.

Several types are available:

For ferrous metals . . . . . ADCOSIL F
For non-ferrous metals . . . . . ADCOSIL NF
For super-collapsibility, all metals. ADCOSIL SC

ARCHER • DANIELS • MIDLAND COMPANY



LIN-O-SET

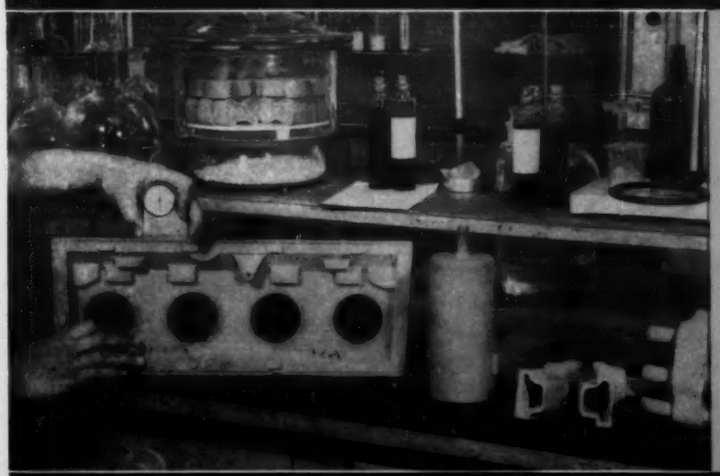
BEST FOR AIR SET CORES...

Original LIN-O-SET, introduced by ADM and praised by large jobbing foundries coast-to-coast, is scarcely a year old. Still, a newer and more phenomenal air-setting binder, LIN-O-SET II, is already available to foundries searching for maximum efficiency.

LIN-O-SET II works in room temperature at exceptional speed hardening the "core of the core" almost as fast as the exposed surfaces. An ADM "first", this development takes the guesswork out of drawing, since the curing of a LIN-O-SET II core combines internal polymerization with surface oxidation.

All this . . . plus the better-known LIN-O-SET features; minimum ramming; saving in cleaning time; thorough collapsibility; elimination of excessive rodding; control of set-up time; improved accuracy; elimination of objectionable odors and toxic gases.

FEDERAL FOUNDRY SUPPLY DIVISION



ADMIREZ

BEST FOR SHELL-MOLDS AND SHELL-CORES...

ADMIREZ CC-240, newly developed in ADM's Resin Research Laboratory, utilizes a cold coating process. It is a dry powdered product containing a cure catalyst which promotes rapid transformation of the resin from a low-melting-point, alcohol-soluble material to a hard, infusible solid under the influence of heated air.

Two basic improvements are offered by ADMIREZ CC-240 over earlier resins: elimination of sand-resin segregation; reduction of economically prohibitive high resin requirements. Advantages are: fast coating; quick breakdown during mulling; high flowability of coated sand; exceptionally fast cure time; excellent stripping from pattern; high tensile strength and lack of brittleness; low-shell breakage; lack of thermal plasticity.

2191 WEST 110TH STREET • CLEVELAND 2, OHIO

Now Included in the Archer Quality Line...

SAN-SLO CORE BLOWER . . . WHIRLMIX SAND MIXERS
FEDERAL GREEN BOND BENTONITE . . . FEDERAL SAND STABILIZER
CROWN HILL SEA COAL . . . and a COMPLETE LINE of FOUNDRY FACINGS

Gentlemen, I am interested in trying: Check One

ADMIREZ CC-240 . ☐
LIN-O-SET II . . . . ☐
ADCOSIL F . . . . ☐
ADCOSIL NF . . . . ☐
ADCOSIL SC . . . . ☐

ARCHER•DANIELS•MIDLAND COMPANY
Federal Foundry Supply Div.
2191 West 110th Street
Cleveland 2, Ohio

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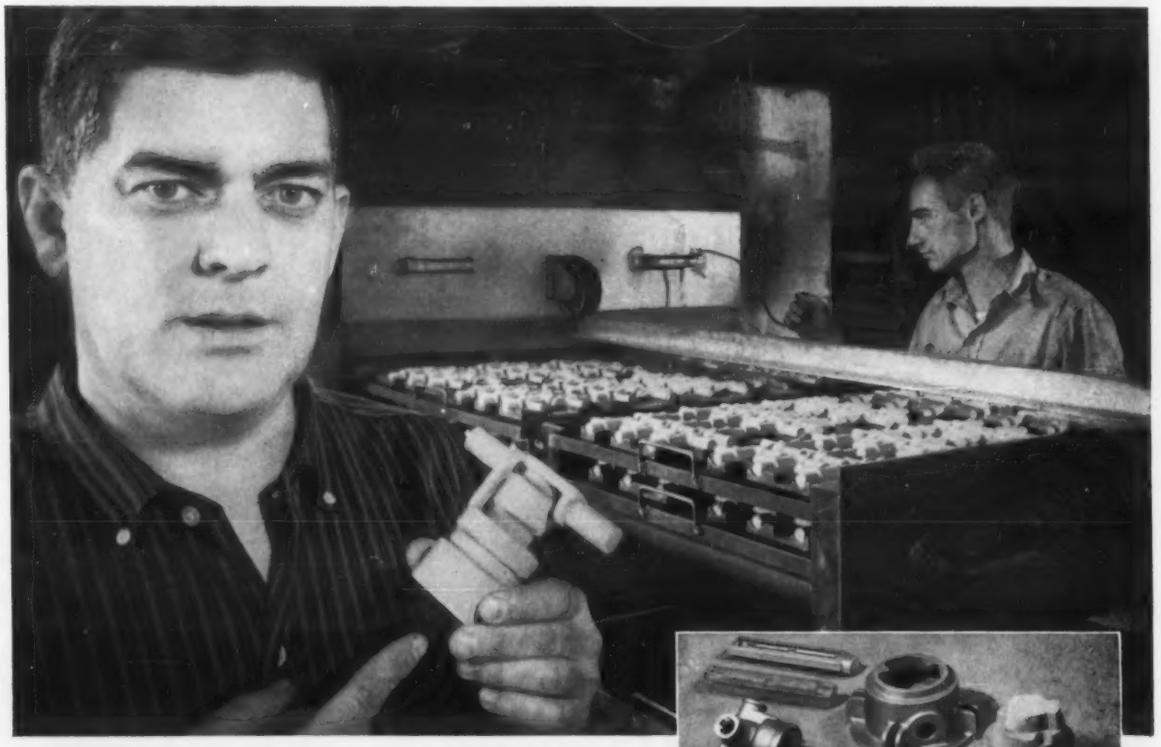
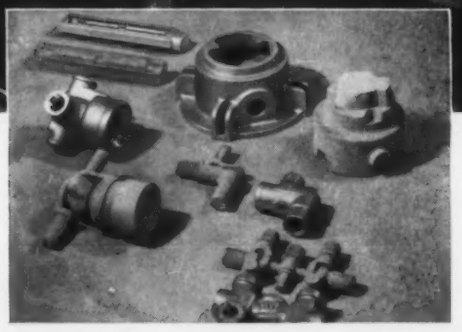
Title_____
Company_____
Address_____
City_____ Zone_____ State_____

Production Foundry Reports:

Amazing Results with NEW Fume-Free...





FOUNDREZ 7605 BINDER

...no smoke, drying cycle cut in half!

"Our use of FOUNDREZ *7605 has been extremely profitable for us. Its fume-free property alone would justify its use... having solved a serious employee turnover problem."* This statement is made by Mr. William E. Virgin, factory superintendent of Samuel Eastman Company, Inc., Concord, New Hampshire.

But that's not all Mr. Virgin has to say about this Reichhold amino-aldehyde thermosetting core binder!

"In addition, by converting to FOUNDREZ *7605, we increased our oven capacity by 75%, cut back our curing cycle by 50%, stepped up production per man-hour in the core department by 20%, reduced maintenance work on core-making equipment, reduced fuel oil cost and eliminated 85% of casting scrap caused by blows."*

You can duplicate the savings made by the Samuel Eastman Company, which has been a manufacturer of fire fighting equipment since 1824. Use RCI FOUNDREZ 7605 for core binding. Reichhold will deliver this unique liquid resin to you in tank cars, tank trucks or drums.

Write to RCI for *Technical Bulletin F-8* which gives full data on FOUNDREZ 7605.

REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N.Y.

REICHHOLD
FOUNDRY PRODUCTS
FOUNDREZ—Synthetic Resin Binders
COROVIT—Self-curing Binders
coRCIment—Core Oils

Creative Chemistry... Your Partner in Progress RCI

Circle No. 335, Page 7-8

Continued from page 17

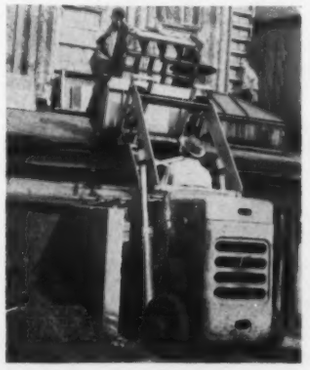
changed over from the old steel idlers to the new type.

All these belts operate at 120-180 ft per min, and carry an average of from 80-100 cu ft per min of sand. Peaks are often reached when 60-70 tons per hour are handled.

For Manufacturer's Information Circle No. 235, Page 7-8

TRACTOR SHOVEL . . . utilizes versatility to increase production 16 per cent for a 20-man foundry, Wisconsin Foundry & Machine Co., Madison, Wis. Manufactured by Clark Equipment Co., Battle Creek, Mich., the Model 12B "Michigan" tractor shovel saves the Wisconsin foundry $50 per day in wages, and releases an extra 30 man-hours a day for pouring gray iron castings.

Refuse removal from the plant is handled in about 15 minutes per day. Prior to purchase of the tractor shovel; used sand, burnt cores, and



other waste averaging four tons a day required eight man-hours to collect, transport, and load into trucks.

Molding sand, once dumped outdoors and brought into the foundry by hand, now is dumped directly from trucks into the 16 cu ft tractor shovel bucket for movement to storage bins.

The unit transfers seven tons in only half an hour, despite maneuvering through a narrow alley every trip.

The tractor shovel picks up and hauls 3,000 lb castings, hundreds of feet from the foundry to rail yard. Storage space and pattern shop are located above the foundry; 1000 lb flasks (photograph) as well as light but bulky patterns are effortlessly lifted between the two floors of the building.

Leveling the foundry floor, a job which had not been tackled for years, was accomplished in two Sat-

urday afternoons by the tractor shovel which easily cut through the hard-packed waste.

For Manufacturer's Information
Circle No. 236, Page 7-8

HEAVY DUTY INDUSTRIAL TIRES . . . still going strong after giving twice the service for metal reclaiming plant as any tire previously used. Photograph shows Mitco Industrial Tires after six months continuous use under 50,000 lb loads over routes often strewn with sharp metal scraps.

The laminated tires were develindustry by the Mitchell Industrial

Tire Co., Inc., Chattanooga, Tenn. Said to eliminate punctures and blowouts, and to normally outlast pneumatic tires 2-6 times; these tires are now offered as standard or optional equipment by 41 original equipment manufacturers.

For Manufacturer's Information
Circle No. 237, Page 7-8

EXOTHERMIC FERRO-ALLOYS . . are packaged for shipping or storing at a saving of as much as $2 per skid load of 60 cans through use of steel strapping at Chromium Mining and Smelting Co., Riverdale, Ill.

The steel strapped skid-loads facilitate crane handling, improve sorting and classified storage, and permit better use of existing storage space. The new packaging method requires steel strapping from the Acme Steel Co., Chicago, and wood skids, corrugated paper, cross-tie seals and strapping tools.

Besides saving the Riverdale company more than $160 per day, the new unitizing method permits better use of storage area; larger, safer crane loads; and quick identification without disturbing the pack.

For Manufacturer's Information
Circle No. 238, Page 7-8

FOR SPEED • FOR FLEXIBILITY • FOR ACCURACY • FOR UNIFORMITY
ANOTHER STEEL FOUNDRY GOES HYDRA-SLINGER!

New from the ground up . . . that's the Steel Foundry Division of Texas Foundries, Inc. at Lufkin. It is not only new, but modern in every respect . . . a leading example of foundry mechanization in the growing southwest. It was only natural for management to decide on the Sandslinger method for ramming all of their larger, miscellaneous patterns. And when it came to choosing a Sandslinger, the choice was Hydra-Slinger because the Hydra-Slinger offers all of the quality, speed and uniformity advantages of hydraulic control.

The new Hydra-Slinger is used in conjunction with a loop roller conveyor and rollover machine. Flasks up to 60 x 60 inches are rammed. Nearly all of the patterns are of wooden construction and pattern changes are made easily without interrupting production. Up to 100 large, heavily cored molds are made each day on a single shift.

The slinger operator is located at a control station in the center of the loop, where he has a perfect view of the ramming operation. The location was chosen as best for this installation, although modern Hydra-Slinger design provides a choice of ideal locations for the control station.

Texas Foundries chose the Hydra-Slinger for their new steel castings plant because it offered a combination of speed, flexibility, accuracy and uniformity unequalled by any other method.

Send for full information today to Beardsley & Piper, Div. Pettibone Mulliken Corporation, 2424 N. Cicero Avenue Chicago 39, Illinois.

Circle No. 336, Page 7-8

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FINE
FANNER
REPRESENTATIVES
ARE AT YOUR SERVICE

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Pacific Graphite Co., Inc.
2522 Malt Avenue
Los Angeles, Calif.
Pacific Graphite Co., Inc.
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Snow & Galgiani
533 Second Street
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Mine & Smelter Supply Co.
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Foremost Fdry. Supply Co.
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The S. Obermayer Co..
2564 West 18 Street
Chicago 8, Ill.

INDIANA
The John M. Glass Co.
18 S. New Jersey
Indianapolis, Ind.
Frederic B. Stevens, Inc.
36 Shelby
Indianapolis, Ind.

KANSAS
Canfield Foundry Supply & Equipment Company
1721 Minnesota Ave.
Kansas City, Kansas

MASSACHUSETTS
Springfield Facing Co.
Williamansett, Mass.

MICHIGAN
A. T. Wagner Co.
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Detroit, Mich.
Frederic B. Stevens, Inc.
1800 Eighteenth
Detroit 16, Michigan
Wolverine Fdry. Sup. Co.
3211 Belleview Ave.
Detroit, Mich.
E. J. Woodison Co.
7415 S. Aubin
Detroit, Michigan

MISSOURI
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St. Louis 2, Missouri
St. Louis Coke & Foundry Supply Co.
1525 Sublette Ave.
St. Louis 10, Missouri

NEW JERSEY
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Harrison, N. J.

OREGON
LeGrand Ind. Supply Co.
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Portland, Oregon

NEW YORK
The E. J. Woodison Co.
146 Chandler
Buffalo, N. Y.
Frederic B. Stevens, Inc.
93 Stone Street
Buffalo 12, N. Y.
M. L. Doelman
66 Russell Avenue
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Lovejoy Patent Spec. Co.
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Cleveland 5, Ohio
Galion Fdry. Spec. Co.
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Galion, Ohio
Fenton Foundry Supply Co.
134 Gilbert Ave.
Dayton, Ohio
The S. Obermayer Co.
647 Evans Street
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S. G. Walton
80 26th St.
Pittsburgh 22, Penna.
J. J. McCoy
5232 Hutchinson
Philadelphia, Penna.

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Houston, Texas
Hill & Griffith Co.
1302 Nance Street
Houston 10, Texas

WASHINGTON
Pearson & Smith
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Spokane, Washington
Carl F. Miller & Co.
1217 6th Ave., S.
Seattle, Washington

WISCONSIN
Fire Brick Engineers Co.
2400 S. 43rd St.
Milwaukee 1, Wisc.
Foremost Fdry. Supply Co.
2400 S. 43rd St.
Milwaukee, Wisc.

The FANNER MANUFACTURING Co.
Brookside Park
Cleveland, Ohio
Circle No. 337, Page 7-8

the editor's field report

by Jack Schrum

■ Want rapid cooling of metal in shell molds? Run the molds under a water spray. Central Foundry Division, GMC, needed faster cooling of their special malleable iron, Armasteel, to avoid mottled structure. Within seconds after pouring, conveyor carries shell molds under water spray that stops burning, cools metal, and gives the desired all-white iron structure needed.

■ CO_2 gassing through porous patterns or core boxes shows promise of improving the speed and efficiency of hardening sodium silicate bonded sands. Besides, it hardens the sand most completely on the important surface adjacent to pattern or core box. This is the surface that must withstand the erosive forces of molten metal and determines the quality of the cast surface.

■ Having trouble with H_2 in stainless steel? Try purging with plastics. This surprising new use for plastics is proving its ability to remove 50 per cent of the dissolved hydrogen in molten stainless when present at about the 0.00008 per cent level. The plastic, C_2F_4, better known as teflon, produces a boiling action when immersed in steel. Metal fluidity is also improved by this treatment.

■ Canadian Iron Foundries Ltd. is experimenting with glass-lined cast iron pipe. This should suggest many new applications for cast iron pipe now requiring expensive alloys.

■ Electronics will soon be making another contribution to casting quality control. An electronic contrast enhancer has been developed for viewing conventional radiographs in such a way that sensitivity of a single film can be extended many fold. By varying the contrast on a viewing screen, details of casting defects can be accurately defined in a variety of cross sectional areas. Present practice requires a number of radiographs to be taken at different exposure times to account for variations in casting thickness. Examined with this new device, a single radiograph can be made to reveal more information than possible to learn from viewing a number of films by conventional techniques.

■ Erosive wear under blow tubes in core boxes can be virtually eliminated by strategic location of vents and blow tubes. Jack Stock, John Deere Waterloo Tractor Works, can show you aluminum core boxes that have been in service over seven years without a repair and no evidence of erosive wear. More than 16,000 cylinder block water jacket cores have been blown in a box that has never been repaired and is still going strong. Watch for more details in a future issue of Modern Castings!

new books

Metal Statistics . . (1957 ed.) Published by the American Metal Market, 18 Cliff Street, New York 38, N. Y. $3.50 in U. S. and Canada; in other countries, $5.00 postpaid.

This annual handbook goes back several decades in charting mineral and metal production and prices. A quick-reference index to the 856 pages lists the following materials: aluminum, antimony, beryllium, cadmium, cobalt, copper, ferro-alloys, fuels, iron ore, lead, magnesium, mercury, nickel, pig iron, precious metals, solder, steel, steel scrap, tin, titanium, tungsten, vanadium, and zinc. There is a buyers' and sellers' guide.

The Effect of Ultrasonics on Molten Metals . . J. B. Jones, J. G. Thomas, and C. F. DePrisco. 127 pp, PB 121403. Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. 1955. $3.25.

Degassing of molten aluminum alloys can be accomplished by ultrasonic activation, according to this extensive research. Accelerated degassing of 195 aluminum alloy was achieved at a nominal frequency of 15 kc. Grain refinement of the alloy also was accomplished with elastic vibratory energy at a frequency of 15 kc. At that frequency, and within the energy levels utilized, RC-70 titanium proved a reasonably satisfactory coupler material. Described along with other results of the research is development of a microphone to appraise elastic energy levels in liquid melts.

Papers of the 24th International Foundry Congress, Stockholm, 1957 . . Two volumes, 28 papers. The price is 53 Swedish kronor for both volumes, including postage, as published by Sveriges Mekanforbund, Karlavagen 43, Stockholm, Sweden.

Abstracts preceding each paper are in English, French, and German.

Diaphragm Molding Subject of Britain Exchange Paper

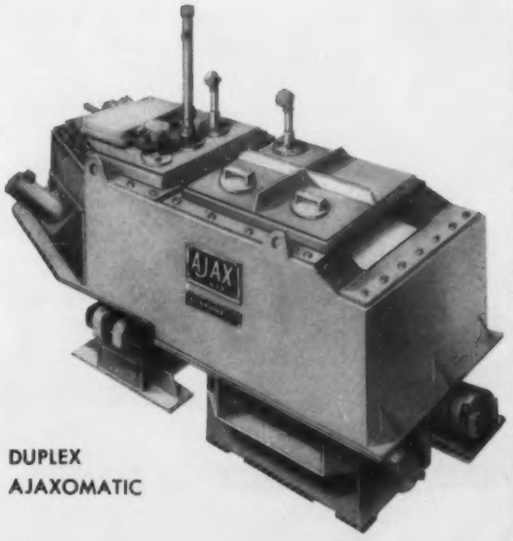
■ The official Exchange Paper, prepared by an AFS member for presentation at the 54th annual meeting of the Institute of British Foundrymen at Buxton, England, in May, is entitled **Pressure or Diaphragm Molding.** Thomas E. Barlow, Eastern Clay Products Dept., International Minerals & Chemicals Corp., Chicago, is the author of the paper.

Following past custom a paper by an I.B.F. member will be presented at the 62nd Castings Congress to be held in Cleveland, May 19-23.

CAN WE STILL AFFORD HAND-LADLING?

AJAXOMATICS

bring automation to die casting



DUPLEX AJAXOMATIC

The Duplex AJAXOMATIC melts aluminum pig and gates right at the die casting machine. By pushing a button the operator initiates the complete casting cycle: the die closes and the Duplex AJAXOMATIC pours the exact required amount of molten metal directly into the cold chamber. The operator just removes the finished casting at the end of the cycle.

Automation, however, is only part of the AJAXOMATIC story. The Duplex AJAXOMATIC also gives assurance of consistent quality. The quality of a finished casting begins with the proper melting of the metal. 60 cycle induction with its two basic features of internal heating and electromagnetic stirring is used exclusively in the Duplex AJAXOMATIC. Here are the unique characteristics of the Duplex AJAXOMATIC:

Precision temperature control — at low temperature	No supply ladle system or hand ladles
Alloy uniformity — no segregation	Precise weight of automatic pour
No gas porosity	Comfortable working conditions
Low metal loss	Low maintenance

The standard Duplex AJAXOMATIC is rated 120 kw to produce 500 lbs per hour of castings ranging from ½ lb to 30 lbs. Other AJAXOMATICS are available to suit a wide range of production requirements, including units supplied from central melting systems. May we have an opportunity to study your requirements?

AJAX USA

60 CYCLE INDUCTION MELTING

ENGINEERING CORPORATION

TRENTON 7, NEW JERSEY

Associated Companies: Ajax Electrothermic Corporation Ajax Electric Company

Circle No. 338, Page 7-S

ENGINEERING
Engineering specialists are available to assist with pattern design and development.

WOOD PATTERN SHOP
Skilled craftsmen, modern woodworking tools combine to produce accurate masters.

FOUNDRY
The latest electric furnaces, controls and methods insure the very finest pattern castings.

A *Complete* SERVICE . . .

METAL PATTERN SHOP
Experienced metalworking personnel carefully pilot patterns through each operation.

MACHINE SHOP
An efficient machine shop provides complete facilities for all pattern machining needs.

LABORATORY
Laboratory "in process" control and inspection insure consistent quality standards.

. . . FROM BLUEPRINT TO PRODUCTION PATTERN

That's right! City Pattern Foundry and Machine Company is equipped with the modern, efficient machinery and staffed with the skilled, experienced personnel to offer you a complete, "start to finish" service on *all* your pattern requirements. Now, obviously, from the standpoint of convenience alone, it pays to have all phases of your pattern development and production under one roof. But convenience, though important, is actually just a "fringe benefit" of City Pattern Foundry and Machine Company service. More important . . . and the reason why so many leading manufacturers rely on our pattern making facilities and knowledge . . . is the fact that our entire operation is geared to combine uncompromising accuracy with maximum efficiency. The result . . . over a period of more than 40 years . . . has been patterns of the finest possible quality at the lowest possible cost.

And that's not all! We're well equipped to serve you in a number of other ways, too. Our foundry department, for example, is one of the most modern and versatile in this section of the country for experimental or production castings, for high conductivity copper, copper alloy, brass and aluminum castings. What's more, City Pattern Foundry and Machine Company offers you complete facilities for fast, accurate, economical machining and fabricating. Want detailed information? Write or call today.

CITY PATTERN
FOUNDRY AND MACHINE CO.

1161 HARPER AVE. • DETROIT 11, MICH.
PHONE: TR 4-2000

Reading Foundrymen Hear Address on Nodular Iron

■ An address, *Nodular Iron as an Engineering Material*, presented by Thomas E. Eagan, Cooper-Bessemer Corp., Grove City, Pa., highlighted the Reading Foundrymen's Association meeting at the Berkshire Hotel, Reading, Pa., Nov. 19. John W. Swengel, R.F.A. president, presided over the meeting attended by approximately 50 members of the Association.

A former AFS National Director, Eagan is chief metallurgist for his firm. He received the 1954 AFS gold medal award for *outstanding work in development and dissemmation of engineering data on the production and integration of alloy cast iron.*

A.S.T.M. Issues Revision of Standards for Copper

■ The American Society for Testing Materials has announced its new publication, *ASTM Standards on Copper and Copper Alloys;* a compilation of standards covering both cast and wrought copper and copper alloys. The new edition contains 34 revisions of the 128 standards appearing in the 1955 edition. Specifications for threadless copper pipe and copper drainage tube are included.

Materials covered, each with applicable testing methods, include: basic coppers; non-ferrous metals used to make copper alloys; ingots, castings, and wrought products.

Record High Aluminum Content in 1958 Models of Automobiles

■ Manufacturers of American automobiles are using more aluminum than ever before, according to R. C. Bichan, Kaiser Aluminum & Chemical Sales, Inc. Use of the metal by the automotive industry has jumped 81 per cent over 1955; latest figures represent a 13 per cent greater use over 1957 models.

Stepped up application of aluminum to car-building is evidenced by the increased use of the metal for grilles, brake drums, automatic transmissions, and power assist units.

As reported by Kaiser Aluminum's research staff, the average amount of aluminum in new models is 44.9 lb as compared to 24.8 lb in 1955.

The largest gain is reflected in General Motors Corp., with an average 30 per cent increase per car for 1958. Chevrolet leads the field with 45 per cent more aluminum this year than in 1957.

Circle No. 339, Page 7-8

obituaries

Robert G. Cady, sales manager and treasurer of Ajax Flexible Coupling Co., Inc., Westfield, N. Y., died Dec. 12 following a short illness. He had been associated with Ajax for 27 years as Chicago sales representative and for the last 15 years handling sales at the factory.

Leland K. Spink, 58, engineer in charge of flow measurement at The Foxboro Co., Foxboro, Mass., died Dec. 23.

Mr. Spink started his career with The Foxboro Company's Tulsa branch in 1924, later transferring to the home factory. Widely recognized as an authority on flow measurement, he pioneered in calculating and coordinating flow data.

Among his inventions are the square root planimeter, and slide rules for sizing control valves and orifices. He was also the author of several flow measurement texts, including the Handbook of Seam Flow Measurement and Practice of Flow Meter Engineering.

Active in the American Society of Mechanical Engineers, he was also a member of Fluid Meters Research Committee, and chairman of the A. G.A.-A.S.M.E. Joint Committee on Gas Measurement.

James H. Critchett, retired vice-president of several divisions of Union Carbide Corp., died Dec. 17 at his home in Orleans, Mass.

He joined the organization in 1914 on the metallurgical staff in Niagara Falls, N. Y. Later he moved to New York as part of the corporation's research organization, subsequently coordinating these activities with those of the manufacturing and sales divisions. He became vice-president of Electro Metallurgical Co. in 1939 and of several other divisions in 1944, which positions he held when he retired.

Mr. Critchett was a member of a number of Government metallurgical committees of the War Production Board during World War II. He was also a member of the National Academy of Science, Electro Chemical Society, American Welding Society, American Society for Testing Materials, American Iron and Steel Institute, and AFS. He was on the executive board of the Welding Research Committee of The Engineering Foundation.

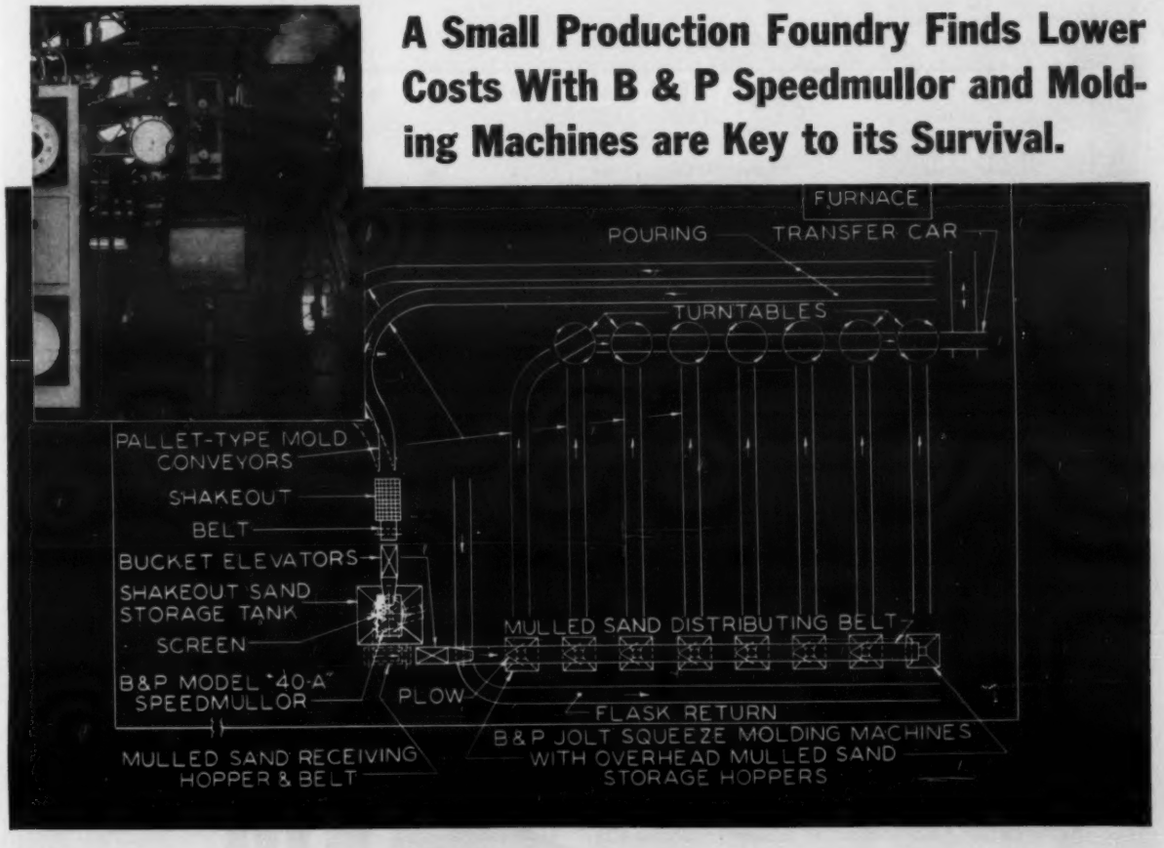
No. 1 in a Series: "Helping the Small Foundry Stay in Business"

LIQUIDATION OR MECHANIZATION?

The Worth Manufacturing Company of Fort Worth, Texas, grew fast, but its problems grew too. Started in 1950 with only three men, this aluminum foundry had 55 employees working three full shifts by 1955. Production was up to 600 molds per day, but poor sand control and unmechanized operation were causing real trouble — nearly $200 worth of castings were being scrapped daily. The foundry faced a crisis . . . to mechanize or go out of business.

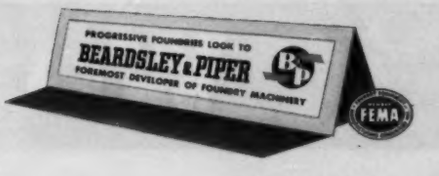
Liquidation was out of the question for this fighting outfit. A '40A' Speedmullor with Speedmullor Cooling, Mulltrolmatic Controls, and automatic moisture controls was installed to provide a quality-controlled, cost-controlled sand practice. B&P Jolt Squeezers were installed to boost molding production, and a Mulbaro was put on the core sand preparation job.

With the help of B&P engineers, the cost of mechanization was held to a low figure . . . in fact, the equipment paid for itself in little more than a year of operation. The results . . . here they are . . . three shift operation cut to single shift . . . 55 man work force cut to 33 . . . individual molder production up from 60 - 90 to 200 - 300 molds per day . . . total mold production up from 600 to 2000 daily . . . scrap losses now negligible.



A Small Production Foundry Finds Lower Costs With B & P Speedmullor and Molding Machines are Key to its Survival.

Worth's story featured in October BETTER METHODS is yours for the asking . . . write today. Beardsley & Piper, Div. Pettibone Mulliken Corporation, 2424 N. Cicero Ave., Chicago 39, Illinois.



Circle No. 340, Page 7-8

WEDRON

A COMPLETE LINE OF 24 DIFFERENT PROCESSED SILICA SANDS

A CONTROLLED GRADE FOR EVERY CASTING NEED!

SAND SPECIFICATIONS — REPRESENTATIVE SCREEN ANALYSES

Unground Sand	4098	4085	4060	4040	4030	4020	5040	5030	5025
Ret on 20 Mesh	2.2								
Thru 20 ret on 30	38.6	12.4	5.6	0.6	0.4	0.4			
Thru 30 ret on 40	57.6	70.8	56.2	37.2	30.2	21.2	4.0	1.2	0.6
Thru 40 ret on 50	1.4	16.3	34.8	52.0	55.8	51.4	34.8	30.4	23.8
Thru 50 ret on 70	0.2	0.5	2.8	9.0	11.4	20.6	44.4	48.2	42.0
Thru 70 ret on 100			0.6	1.0	1.8	5.2	14.4	17.8	26.4
Thru 100 ret on 140				0.2	0.4	1.0	2.0	2.0	6.2
Thru 140 ret on 200						0.2	0.4	0.4	0.8
Thru 200 ret on 270									0.2
Grain Fineness (AFS)	25.88	30.49	33.72	37.48	38.82	42.22	49.96	51.64	56.90

Unground Sand	5015	5010	5005	7030	7020	7010	C-30	C-10
Ret on 20 Mesh								
Thru 20 ret on 30								
Thru 30 ret on 40	1.2	0.4	0.2	0.2	0.2			
Thru 40 ret on 50	15.2	11.2	4.4	3.0	2.4	0.4		
Thru 50 ret on 70	40.2	35.2	31.2	26.2	18.0	8.2	0.4	0.2
Thru 70 ret on 100	35.4	37.4	41.2	42.0	45.0	46.6	28.4	8.4
Thru 100 ret on 140	6.4	10.8	15.4	16.4	20.0	23.2	44.8	50.2
Thru 140 ret on 200	1.2	4.0	5.6	9.6	11.0	15.4	18.8	28.2
Thru 200 ret on 270	0.4	0.8	1.4	1.8	2.4	4.2	5.0	8.8
Thru 270 ret on 325		0.2	0.6	0.8	1.0	2.0	2.6	4.2
Grain Fineness (AFS)	60.20	66.92	73.92	79.36	84.42	95.44	108.22	124.60

Ground Sand (Flour)	80M	100M	140M	200M	300M	325M	400M
Ret on 60 Mesh	10/20%						
Thru 60 ret on 100	25/30%	5%					
Thru 100 ret on 140	15/20%	14%	4%	1%			
Thru 140 ret on 200	10/15%	16%	6%	4%	2%	Trace	
Thru 200 mesh	25/40%						
Thru 200 ret on 270		10%	12%	6%	2%	0.5%	Trace
Thru 270 ret on 325		12%	8%	9%	11%	4.5%	2%
Thru 325 mesh		43%	70%	80%	85%	95.0%	98%

99.9% PURE SILICA WEDRON SILICA COMPANY INDUSTRIAL SAND

FINE SHELL MOLDING SANDS
STANDARD CASTING SANDS — BLASTING SANDS
SILICA FLOUR — LIGHT METAL CASTING GRADES

Wedron offers you a complete line up of casting sands — anything needed for every *casting* need! This means you get the advantages of one source of supply for all the sand you need — sand of the highest quality, too.

Now this Wedron quality stems from two factors. First is the naturally rounded grain sand of the Ottawa-Wedron district (this is held to be one of the purest silica sand deposits in the nation). Second is the modern, completely equipped Wedron plant, which turns out a superior silica product and makes all grades available.

Look to Wedron for the *complete* line of quality casting sands.

MINES AND MILLS IN THE OTTAWA-WEDRON DISTRICT

WEDRON SILICA COMPANY

135 SOUTH LASALLE STREET, CHICAGO 3, ILLINOIS

Circle No. 341, Page 7-8

the SHAPe of things

safety, hygiene, air pollution

by HERBERT J. WEBER

DANGER! SHOE FITTING

Last December we sent the following important notice to all Illinois members of AFS:

"If you own or operate any kind of radiographic equipment such as . . . . xray, betatrons, radioactive isotypes, etc., it must be registered with the Illinois Department of Public Health not later than January 1, 1958, or you may be subject to a fine of $1,000 and six months in prison for each day of failure to register. The law is all inclusive and covers not only industrial but medical and first-aid equipment as well."

The Illinois Radiation Installation Registration Law was the result of recommendations made by the Illinois Atomic Power Investigating Commission which was created by the 69th General Assembly to study, in addition to other related issues, the economic and social impact of the civilian use of atomic power upon the citizens of Illinois. It was the opinion of the Commission that the extent of hazards related to the use of radioactive materials and radiation machines could not be evaluated *until the location and uses of these materials were known and studied.*

As a result the Commission recommended that radiation installations be registered with the Department of Public Health so that a complete evaluation of health hazards could be made.

It was the opinion of the commission and of experts in this field that statutory registration of radiation installations was the most practical approach to the question concerning the need for *state control* over radiation materials and devices. The occasional accidents with radiation materials emphasized the need for the type of study conducted by the Commission, but it was the ever-increasing use of such devices with their potential public health problems which prompted this action.

Pennsylvania's Regulation 433 of the Radiation Protection Act requiring registration was passed Oct. 20, 1956. New York's industrial code rule No. 38 was passed in 1955.

Here is a list of the high caliber men serving on this committee:

MACHINES OR X-RAYS

I. Craig Roberts, Chairman — Atomic Energy Commission
Floyd S. Sutherland, Vice-Chairman — Blaw-Knox Co.
Wm. Brobst, Atomic Energy Commission
Dr. E. H. Carleston, Inland Steel Co.
Leonard Cole, Crane Co.
Theodore Fields, Hines Veterans Hospital
B. A. Hindmarch, American Steel Foundries
Don Hubbard, General Electric Co.
Dr. M. H. Kronenberg, Caterpillar Tractor Co.
A. L. Pace, General Electric Co.
Clifford Sorensen, National Malleable & Steel Castings Co.
Dr. A. J. Stevens, The Budd Co.
Geo. E. Tubich, Michigan Department of Health

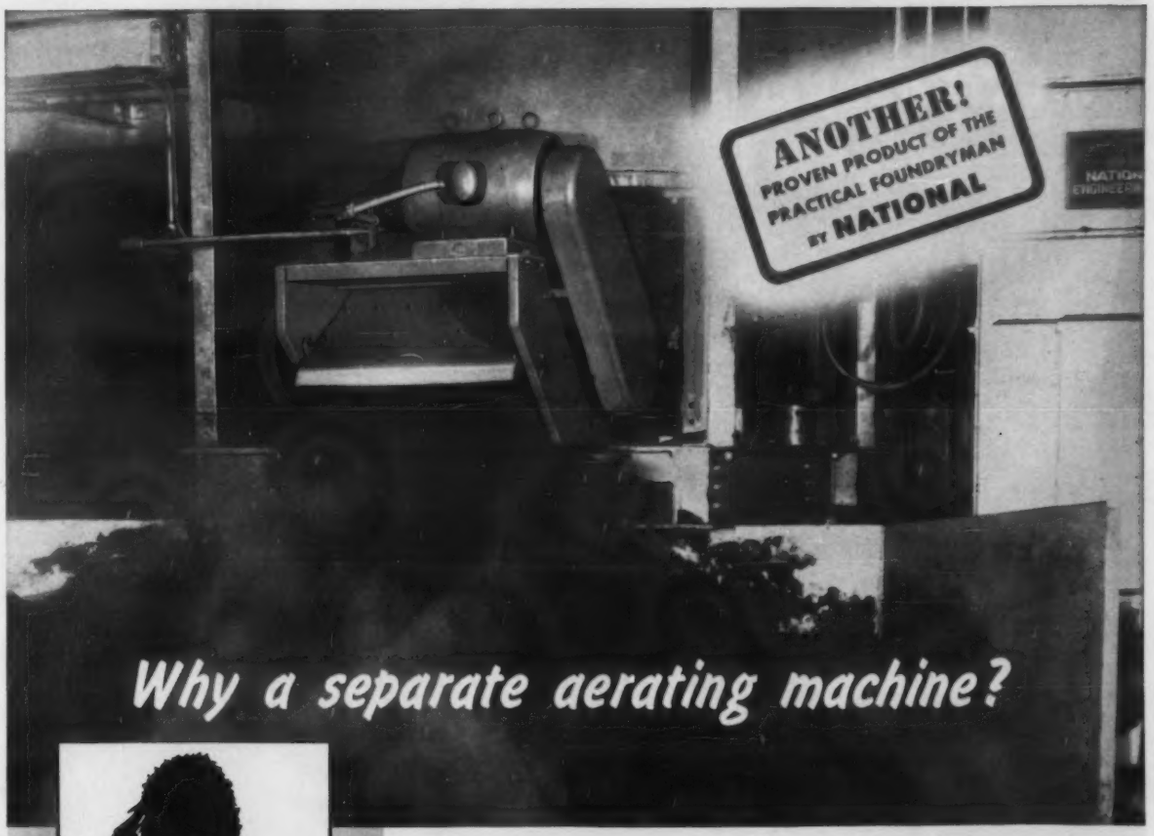
The action of these three states indicates a trend which will lead eventually to state control of radiation-producing materials and devices.

AFS anticipated this when it formed the Radiation Protection Committee in February, 1956. This committee has been active since and will publish in 1958 the "*AFS Radiation Protection Manual for Foundries.*"

We have always felt that it is preferable to write our own safe practices rather than to have others write them, and our committee is doing just that.

Some of the subjects included in the manual are as follows:

Introduction
Nature and Sources of Radiation in the Foundry
Health Aspects of Radiation
Control of Radiation in the foundry
1) Personnel requirements
2) Equipment and Facilities
3) Administration
4) Maximum Permissible Dose
Radiation Detection Instrumentation
Protection by Shielding and Distance
Procedure for Handling and Use of Sources of Radiation
Training of Personnel
Glossary



Why a separate aerating machine?

Aerate your sand in half the time with the *improved* National Aerator.

- **Rotors last twice as long**
- **Aerate sand as fast as mixer discharges**
- **30 to 50% reduction in power required**
- **No sand build-up with new rotor design**

Write for specification sheet on National Aerators or ask for quotation on low cost conversion kit for your present National Aerator.

If aeration is important to the quality and handling of your sand you need an aerating machine. Here is why National recommends separate aeration and why and how National Aerators make riddling unnecessary and provide free flowing, lump-free, easy-to-handle sand at the molder's station:

National Aerators are especially designed for direct attachment to the discharge opening of a Simpson Mix-Muller. The action is *fast, gentle* (no segregation of sand and binder) and *positive* . . . Special hardened combing fingers gently comb and fluff the sand without stripping or damage to coated sand grain.

Because National Aerators are specifically designed to *aerate sand* you'll get these benefits too: long wear life; *effective*, economical power usage with no hindrance to mixing action or quality of the prepared sand.

There's a National Aerator for every model of the Simpson Mix-Muller. And you can choose from several models of belt-type and conventional system aerators—for use *anywhere* in your system. *It's another product of the practical foundryman.*

NATIONAL ENGINEERING COMPANY
630 Machinery Hall Bldg. • Chicago 6, Illinois

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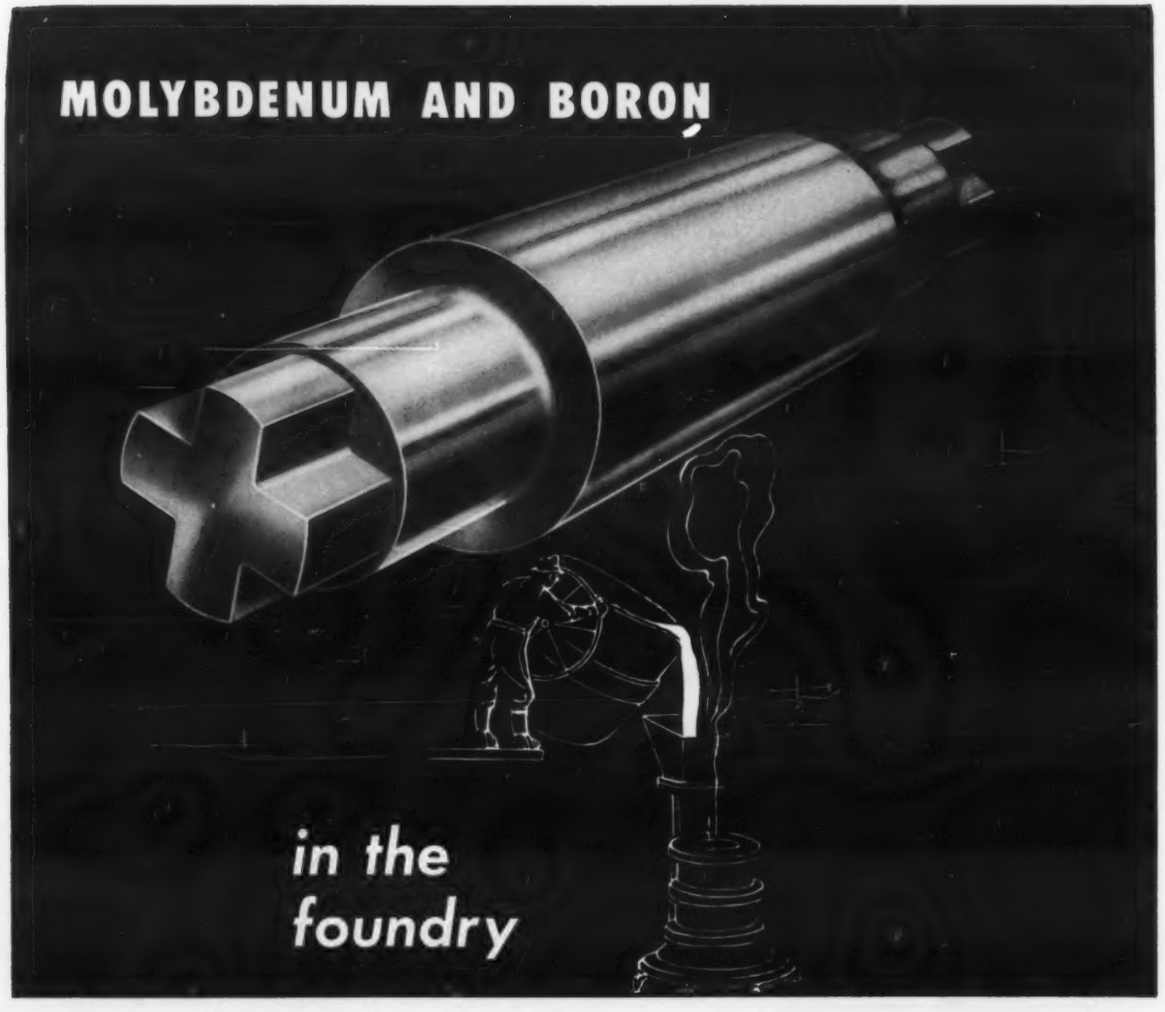
Circle No. 342, Page 7-8



Rolls are among many cast, wrought iron and steel products that have been improved by Molybdenum and Boron. Very small additions, properly introduced, yield surprising results. MCA Molybdenum additions increase the resistance of rolls to breakage, chipping, heat checking and spalling in service. Molybdenum and Boron improve toughness and hardness qualities at both room and higher temperatures.

Similarly, Molybdenum and Boron are effective in improving toughness and hardness in both light and heavy iron and steel castings.

As recognized authorities in the application of Molybdenum, Tungsten, Boron, Cerium and its derivatives both as alloys and chemicals, MCA assures confidential and immediate reponse to inquiries.

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Subsidiary: Cleveland Tungsten, Inc., Cleveland Plants: Washington, Pa., York, Pa.

MCA

Circle No. 343, Page 7-8

New Foundry Equipment—

Leasing Equipment Offers Economy to Production

BY GEORGE S. HARTMAN / *Production Specialist*
Small Business Administration
Washington, D. C.

■ When the question arises, "Is it better to purchase or to lease new equipment?" several factors should receive careful consideration. The Federal Small Business Administration states that the increasing cost of labor means that maximum production must be obtained from equipment if a plant is to remain competitive. A machine can be obsolete in spite of being in excellent mechanical condition. If leasing offers a larger return on capital than anticipated profits from a purchased tool, leasing the equipment would be sound.

Advantages of Leasing

For the small business owner who has limited capital, leasing allows the lessee to expand his production without increasing his financial burden. The small firm is placed in a more competitive position since equipment may be rented for peak periods only.

A highly technical machine requires expert servicing; leasing is often advantageous since such service may be provided by the owner. In some cases, leasing could be the only way in which to acquire new equipment; the firm may have been allowed maximum use of its short-term credit, or there may be a shortage of investment capital.

Users of leased equipment are able to increase production by discarding obsolete equipment and quickly obtaining modern tools.

Disadvantages of Leasing

Prestige of ownership is sometimes an important psychological consideration; leasing may reflect lack of success. Specialized equipment probably cannot be rented again after the job is completed. Shortage of available machinery or too-early removal are practical considerations. Some leasing agreements limit the use of tools, or entitle lessor to provide supervision; both of which could result in inconvenience.

Leasing has been used for years in the shoe-repair and office-machinery businesses, and more recently in railroad equipment. But in machine tool and other areas of production equipment, the value of leasing is just beginning to be realized.

■ For more information on leasing equipment, Circle No. G, Reader Service Card, pages 7-8.

Buy or Lease?

Loans for Modernization Made on Company Assets

BY RUSSELL R. CAMPBELL / *Vice-President*
James Talcott, Inc.
Chicago

■ The trend towards automation presents a problem for foundries with low working capital. But this situation is nothing new for James Talcott, Inc., Chicago, which has been financing business firms since 1854.

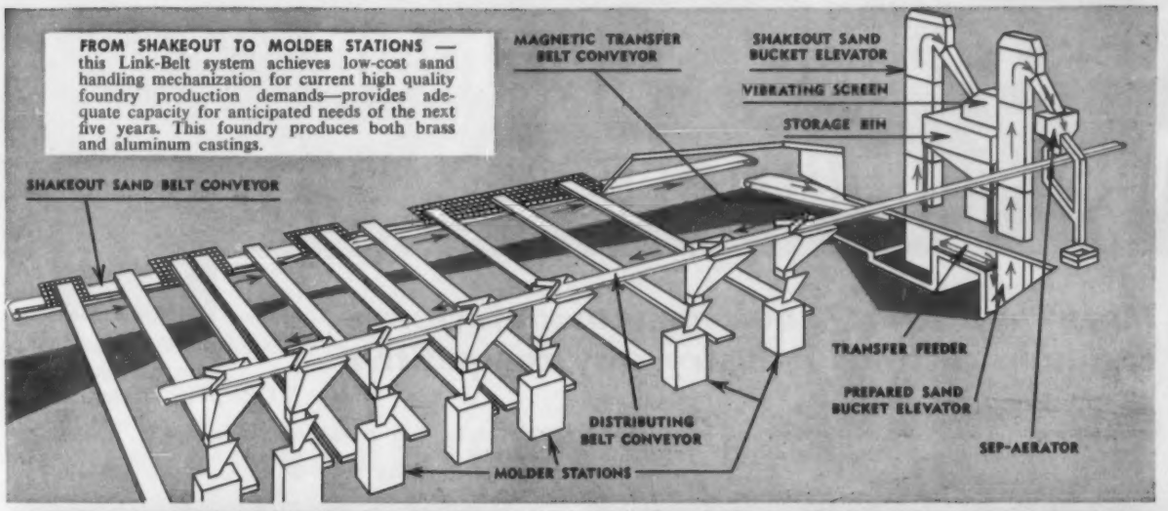
For the foundry in need of money for new equipment, the financing institution first analyzes the firm's financial statement. Accounts receivable are assigned to the finance company without notification to customers. Funds are advanced on the receivables, and repayment is made as the accounts are collected; it becomes in effect a revolving working capital loan based on new accounts created, etc.

If additional financing is required, loans may be secured by inventory and/or plant and equipment. The lending institution has on record a total loan of $320,000 advanced on accounts receivable, plant, and equipment necessary for a firm to complete its modernization program.

An alternate solution to the problem involves cooperation of equipment manufacturers, who are offered one of several time payment plans for industrial equipment. Firms such as Talcott specialize in financing industrial equipment, and are not a part of the consumer finance field. Financing plans are suggested which best suit the firm desiring funds, and the equipment to be purchased. In general, this permits the foundry buyer to pay on equal monthly payments up to three years or longer.

In summary, while there is always a solution to a financial problem, the solution depends principally upon the condition and the needs of the industrial buyer. Further, while a low "finance charge" is important, it does not represent the total cost. A finance company that eliminates cumbersome routines and provides for the shortest possible debt retirement does the best over-all job for its client.

■ For more information on loans circle No. H, Reader Service Card, pages 7-8.


FROM SHAKEOUT TO MOLDER STATIONS — this Link-Belt system achieves low-cost sand handling mechanization for current high quality foundry production demands—provides adequate capacity for anticipated needs of the next five years. This foundry produces both brass and aluminum castings.
MAGNETIC TRANSFER BELT CONVEYOR
SHAKEOUT SAND BUCKET ELEVATOR
VIBRATING SCREEN
STORAGE BIN
SHAKEOUT SAND BELT CONVEYOR
TRANSFER FEEDER
PREPARED SAND BUCKET ELEVATOR
DISTRIBUTING BELT CONVEYOR
SEP-AERATOR
MOLDER STATIONS

DISTRIBUTING BELT CONVEYOR for prepared sand runs directly above individual molding stations. Conveyor is equipped with air-actuated duplex plows which deliver sand to series of molders' hoppers. Finger tip selection assures availability of sand where required and in quantity desired.

BRASS FOUNDRY achieves smooth coordination of sand handling and molding operations in compact area. Link-Belt equipment includes vibrating screen, storage bin, prepared sand bucket elevator, Sep-Aerator, overhead belt conveyor and molding stations.

In 1946...in 1956—Link-Belt helps Gardner-Denver Company

mechanize for greater profit

HAVING experienced many years of dependable, low cost handling of sand, molds and castings with Link-Belt equipment at their La Grange, Missouri foundry, Gardner-Denver Company again had Link-Belt mechanize their new Quincy, Illinois foundry.

Results — a clean, orderly foundry, maximum capacity, better working conditions, uniformly prepared sand, fewer rejects—all of which make for better castings at a lower unit cost. Yes, you get these and many more benefits when you mechanize with Link-Belt sand handling equipment. Call your nearby Link-Belt representative for consultation on your sand, mold and castings handling problems. Or write for Book 2423.

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World. 14.023

Circle No. 344, Page 7-8

Does Foundry Equipment Meet Foundry Needs?

More research by equipment manufacturers can help castings industry stay competitive

FRANK W. SHIPLEY /
Foundry Manager
Caterpillar Tractor Co.
Peoria, Ill.

Both the foundryman and the foundry equipment manufacturer depend on the continued development and prosperity of the foundry industry. In this respect the two are inseparable.

If the castings industry is to hold or improve its present position in the expanding economy, it must compete with other fabrication industries. To do this successfully, the industry must have a great deal of help from the equipment manufacturers in the way of improved equipment and techniques which will allow reduced costs and improved quality.

The castings industry realizes that better ways of doing things must be developed—better machines, better materials, better processes, and a better grade of personnel. To accomplish these purposes, foundrymen recognize that a free and open exchange of ideas must become a reality if the industry is to obtain its share of a constantly improving and an ever increasing market.

The American Foundrymen's Society can justly be proud of its record of accomplishment in this area, for it has certainly been a great factor in bringing about that exchange of information which, to a great degree, has stimulated the tremendous improvements in the castings industry in the past 25 years.

There must now be a still greater exchange of knowledge between the foundrymen of tomorrow and the foundry equipment manufacturer.

The foremost thing expected from the foundry equipment industry is continuous improvements in equipment and technology so as to enable the castings industry to attract personnel with a higher level of education.

Such results could have a snowballing effect because, as more people of this caliber are obtained, remarkable achievements in processes and quality of products could be attained.

To accomplish such continuous improvement in equipment and technology, most foundrymen feel that the equipment industry should devote a great deal more effort in improved application research. If applied research develops improved equipment or processes which are profitable for the foundryman to use, he will find a way to buy it.

MATERIALS HANDLING

■ It has been estimated that from 30 to 40 per cent of the cost of making castings results from handling material of one kind or another—every time pig iron, scrap iron, cores, core boxes, sand, molds, flasks, molten metal, castings, and hundreds of other items are moved in the foundry, it costs money.

By extensive surveys and careful studies it has been calculated that a foundry handles 200 tons of material for every ton of finished castings produced.

With the millions of dollars spent on this one item alone every year, it should be a most fertile field for concentrated research.

The castings industry is a basic industry with an output of over six and one half billion dollars annually; yet the average unit-plant size, in number of employees, is only 70.

Nevertheless, ideas can be taken from those developed for the large specialized plant and applied in a smaller less expensive way for use in the small foundry. Considerable savings in material handling cost can be effected even though they may be unable to reach the ultimate ideal possible in the large specialized foundry.

SAFETY, HYGIENE and AIR POLLUTION CONTROL

■ Here is a field in which considerable research needs to be done. Improvements must be made in foundry environment to attract a better grade of personnel. Better to make these improvements in advance rather than wait for the force of legislation.

A great deal of research needs to be done to develop cheaper, more efficient dust and smoke collecting equipment.

Following closely behind safety, hygiene and air pollution is the problem of noise abatement. Excessive noise creates just as undesirable a working atmosphere as smoke and dust, and from a medical standpoint, it may be just as unhealthful.

It will take considerable research and engineering man hours to develop the equipment which will lick this problem.

Foundrymen Report on Foundry Equipment

■ To find how other foundrymen would answer the question, "Does foundry equipment meet foundry needs?", MODERN CASTINGS contacted 25 selected foundries. All replied and all but five had serious gripes. At least half offered constructive suggestions. Here are some of their remarks.

We had an entire molding department shut down for two days by the breakdown of a single machine . . .
California foundryman

We actually had to hire a taxi to pick up and deliver a spare part from an equipment plant 200 miles away. The entire foundry was shut down while we waited for that part . . .
Michigan foundryman

We always get overnight service on spare parts from an equipment builder located 300 miles away . . .
Kentucky foundryman

Faster melting would be possible if manufacturers could build gas furnaces to use the boron-based fuels now being produced for use as rocket propellants . . .
Texas metallurgist

Our plant once waited two months to get a part for a weighing scale. We had to handle all materials twice during this period. This inconvenience cost many times the value of the broken part . . .
Illinois foundryman

One equipment manufacturer will fly a maintenance man in immediately to help get equipment back into operation . . .
Michigan foundryman

Foundries will be better places to work when all equipment has built-in safety guards and noise-suppression features . . .
New England foundryman

The most important advance in materials handling has been the introduction of mechanical charging of the cupola . . .
Illinois foundryman

Many equipment manufacturers take foundry customers to other plants to see equipment in actual operation to give them a better understanding of what the equipment can do for him . . .
Alabama foundryman

Materials handling people should find a replacement for crane hooks and chains. It takes too much time to chain up a load . . .
Wisconsin foundryman

Salesmen tend to oversell; they don't use good judgment in advising; and they recommend their equipment whether it is suitable for the application or not . . .
Indiana foundryman

An equipment manufacturer was unable to provide a replacement part for a 20 year-old machine that broke down in our plant. We were forced to have the part custom-made at a machine shop . . .
Minnesota foundryman

MELTING and METALLURGICAL CONTROL

■ In metal melting and metallurgical control many improved techniques have been developed. With the advent of the electric furnace and the subsequent development of the duplexing process, the introduction of the hot-blast cupola, the water-cooled cupola etc., control techniques have been improved.

New metals, both ferrous and non-ferrous, must be developed to meet the demands of higher speeds, higher output, and higher temperatures required by the jet age and the atomic age. The aircraft industry, discouraged by its inability to get castings resistant to high temperatures of the jet age, has turned to other industries. Few foundries are willing to tackle the job of many aircraft and atomic specifications. Few furnace manufacturers seem concerned with equipment needed to meet foundry specifications.

MAINTENANCE of EQUIPMENT

■ A related field in which the foundryman needs help from the equipment industry is this item of maintenance—the problem of keeping the equipment running.

One of the biggest bugaboos in the foundry today is breakdown of machinery.

Machine design improvements are needed to reduce machine down time and maintenance costs. This can be done by designing machines and components for rugged service and convenient maintenance.

A better understanding of the sources of equipment failures and shortcomings is needed. Equip-

THE LAST WORD

To be fair, MODERN CASTINGS has asked 25 manufacturers to present their side of this story. Their anonymous comments will be presented in the April issue of MODERN CASTINGS.

To aid in maintenance, equipment makers should put lubrication fittings where it is humanly possible to service them conveniently . . .
Wisconsin foundryman

Wear points on foundry equipment can be anticipated and stocks of replacement parts should be maintained by the foundry . . .
Pennsylvania consultant

ment designers should spend time with the actual equipment operators and these same designers should actually see the equipment disassembled and repaired under operating conditions. A desirable motto for machine designers should be "Put Yourself in the Machine Operators and Maintenance Man's Place".

An excellent practice is to send practical servicemen to the various plants where you have equipment installed to teach the operating and maintenance people how to keep the machine running—what danger signals to look for—how to repair it quickly when it does break down.

Training schools are needed at the customer's plant to teach his people how to properly maintain the equipment through a preventative maintenance program and how to get it back in running order if it should break down.

For improved equipment operation and reduced maintenance, all bearings, valves, limit switches, and air and hydraulic equipment must be equipped with heavy duty dirt seals. This will avoid abrasive wear of critical equipment and parts.

Convenient and adequate provisions for lubrication of machine parts under adverse operating conditions is an essential adjunct to heavy duty dirt seals. Equipment should be designed so that highly vulnerable moving parts, requiring frequent lubrication, cleaning or adjustment are readily accessible. It is an old axiom that *places which are difficult to lubricate, won't be.*

Standard heavy duty component designs suitable for the foundry should be encouraged from accessory equipment manufacturers.

The use of standardized components simplifies the maintenance and greatly reduces spare parts inventory. For example, sub-base mounted hydraulic control equipment with heavy duty dust and oil proof disconnect plugs expedites maintenance operations.

Heavy duty electrical relay and motor control equipment mounted in dust proof cabinets with sufficient air volume to allow dissipation of the heat generated by the controls is an excellent means of reducing maintenance troubles.

All new equipment should be accompanied by an adequate number of carefully explained and diagrammed installation, operation and maintenance instruction sheets including lubrication instructions, complete spare parts lists, and lists of spare parts recommended by the manufacturer to be carried in inventory. All parts should have an actual part number describing *one* and only *one* part. Item number and sheet number descriptions are wholly inadequate.

If any part is the standard product of another manufacturer, the parts list should identify the item in this manner.

Equipment redesign merely to improve appearance is foolish and an unnecessary expense unless easier cleaning or improved operation or more convenient maintenance is accomplished.

THE SALE of FOUNDRY EQUIPMENT

■ The sale of equipment is only the first, and incidentally one of the least important contacts which the foundry equipment manufacturer has with his customer. Subsequent contacts, after the equipment is in use, will determine the attitude of the customer toward the manufacturer.

Some of the points which will go a long way towards determining the attitude of the customer are listed in the form of questions:

■ Is the manufacturer willing to make slight modification in his equipment that will benefit the user without requesting excessive additional compensation?

■ Does the manufacturer suggest changes or modifications that will make his equipment more productive, easier to operate, safer or more maintenance free even after it has been purchased and in use?

■ Does the manufacturer meet his promised delivery date?

■ Does the manufacturer inquire about his equipment and its performance even years after it has been placed in operation?

■ Does the manufacturer accept suggestions from the user on ways to improve his equipment?

■ Does the manufacturer continue to make parts available and provide service for the lifetime of the machine?

All of the points emphasized in this article could be covered by the one word, *service*. It's not a big word, but it sums up all the relations between the manufacturer and the customer after the sale of the equipment and certainly has more bearing on future sales than any other one item.

Most estimates point to a gross national product of six-hundred billion dollars by 1975. If the castings industry only keeps pace with the expanding economy, its share of that market will exceed ten billion dollars. The castings industry can increase that market with the help of the foundry equipment manufacturers.

Developments being made now by equipment manufacturers will determine the position of the metal-castings industry even beyond 1975. Fifty years from now, castings producers will be competing in new markets using tools and techniques which will be the product of research to be done now and in the near future.

The casting producer of 50 years hence will be much more specialized than today as regards the type and size of castings and the metal specification being produced. A single purpose plant producing one given type of casting can be much more efficient because productivity per hour of labor can be greatly increased through the use of continuous processes.

Development of higher strength metals and improvements in the continuous controls of the whole casting process from the raw materials through the melting and final inspection will make possible the use of cast parts where rolled, forged, or welded parts are now used. The use of isotopes, sonic and ultrasonic analysis, as well as radiography, will be important in future process.

The trend toward more intricate designs of castings, the grouping of several separate components into one castings, will spur the development of inert, inorganic materials for use in making cores and molds.

The development of comparatively low cost electricity from atomic power plants will increase the use of electricity in melting. Furnaces will be of the continuous type to produce large tonnages of uniform metal.

Less cleaning will be required because castings will be made to more exact dimensional standards.

These advances, and more as yet unforseen, will be developed to assure future sales of castings and equipment to produce castings.

■ To obtain single additional copies of this article circle A, Reader Service Card, pages 7-8.

The installation of new equipment presents the foundry with the problem of payment. If cash for the purchase is not available, new equipment may be financed, or installed on a leased basis. For details on these two programs, turn to page 26-27.

How New Equipment Meets the Needs of GARDNER-DENVER FOUNDRY

Marked increases in efficiency and decreases in costs have resulted from a widespread expansion and realignment of the foundry division of Gardner-Denver Co., Quincy, Illinois. After a year of production in the new facilities, scrap and man hour figures are considerably below those of previous years.

New buildings were built and much new equipment has been installed or ordered. Installations in the brass and aluminum foundry include: four new jolt-squeeze machines; gravity-roller conveyor systems; five new tilting furnaces for melting; and transporting equipment. New equipment in the iron foundry includes: three drawer, small core baking ovens; five large car-type baking ovens; a new muller system; an extra large jolt machine—12x16 ft; and various other smaller pieces.

The expansion of the foundry operations included moving the entire brass foundry to a new building and renovating and relocating machinery and equipment in the iron foundry. The project was accomplished in less than one year. Full production was reached in August, 1956.

Almost a year later scrap was less than 0.75 per cent in the foundry. Total foundry and machine shop scrap was only 1.48 per cent. Man hours of production and supervision average 51.89 per ton. Castings, ranging from 1000 lb to 11.5 tons, are for compressors, rock drills, pumps, air motors and hoists, mine car loaders, and contractor and maintenance tools produced by Gardner-Denver.

New Buildings

The new building additions include a 60x160 ft section, housing casting cleaning operations and floor molding, and a 36x120 ft core oven room, adjacent to the iron foundry. The new brass foundry occupies a 50x280 ft building. Two new locker rooms—one each for the brass and iron foundry—cover a 24x140 ft area. These new areas add up to a total of 31,280 sq ft of new working area.

In the iron foundry a general relocation of old equipment came about through the installation of new machines. All equipment has been installed in positions that will encourage efficiency and comfortable working conditions.

The brass foundry was moved in three weeks from the Walton Heights vicinity to Plant No. 1 in Quincy. The building and relocations in the iron foundry did not interrupt production.

Along with the new and modern equipment that has been installed for efficiency, the expansion program has also emphasized the comfort and safety of workers. In the brass and aluminum foundry, for example, workers are supplied ample lighting from two large banks of windows along with lighting fixtures at individual work spots.

At casting grinding sections, air contaminants from cut-off and grinding equipment are vented through a down-draft system to a wet-dust collector. Another down-draft system removes contaminants from bench areas to a second wet-dust collector. Supplementing these, ceiling fans exhaust fumes and dust.

■ To obtain single additional copies of this article, circle B, Reader Service Card, pages 7-8.

Car-type ovens with 40,000 lb capacity utilize air motors and cable rigs to move core laden cars in and out of the ovens for baking.

Metal is tapped into small ladles which are carried by monorail conveyor to precise spot where molds are poured.

Pump casting being lifted by crane from shakeout equipped with extensive new dust collecting system.

FIRE!

EMMETT F. HINES / *Manager*
NEMCO Foundry
Tulsa, Okla.

Patterns were burned, equipment damaged or destroyed, but management action restored NEMCO's production in 40 days

How soon can a foundry get back into production after being extensively damaged by fire? NEMCO Foundry of the Nelson Electric Manufacturing Co., Tulsa, Okla., did it in 40 days.

Shortly after 4 am Aug. 16, 1956, smoke and flames were seen shooting up through the metal roof of the ten-year-old foundry building. A passer-by turned in the alarm. About half of the building was in flames when the fire trucks arrived several minutes later. Firemen quickly moved the foundry truck, fork trucks, and other plant motorized equipment out of the danger area.

Water from the fire hoses was directed at the flames and at portions of the building and equipment not yet reached by the fire, in order to prevent the flames from spreading. A second alarm was turned in 10 minutes later. The fire was under control by 6 am.

The Damage

The cause of the fire was not determined but it was believed to have started near the pattern shop and spread to the shower room, office, and pattern storage area. The pattern shop was completely destroyed. Besides all woodworking machinery and tools, many patterns in the shop for checking were ruined by fire and water. The shower room was a complete loss, including all plumbing fixtures and lockers, together with employees' personal clothing.

Ninty per cent of the patterns stored in the plant were destroyed.

$100,000 fire was believed to have started near the pattern shop.

The office was heavily damaged. All office equipment was lost, but 80 per cent of the office records, protected by steel filing cabinets and desks, were saved. Of the patterns in the storage room, 90 per cent were wood and had been destroyed by fire. Only a few patterns could be salvaged.

The Job of Rebuilding

About 50 per cent of the foundry building was damaged extensively, including the electrical wiring and fixtures, all of which had to be replaced. Foundry equipment, such as the machinery for production molding, had been damaged by heat and water but the majority could be repaired. The overhead crane was so badly damaged that it had to be replaced. All utility pipes for air, gas, and water were distorted from the heat and had to be replaced. Damage to the foundry floor required that it be dug out and reclayed.

At 8 am, four hours after the fire was first discovered, the foundry management held an emergency meeting. The group decided on a crash program to clean up the debris and start rebuilding immediately to get back into production in the shortest time—within thirty days if possible. Clearing away the debris and tearing down the damaged portion of the building was begun while the ashes were still warm.

Fortunately, all drawings and specifications for the building, equipment, and a substantial number of patterns had been stored in a fireproof vault of Nelson Electric Manufacturing Co. some ten miles away.

NEMCO Foundry supplies its parent company with gray iron castings for explosion-proof electrical equipment.

Their engineering department began working "around the clock" to bring up to date the drawings for the patterns which the manufacturing company used. The fire had taught an important lesson—*that pattern drawings should be brought up to date after each revision.* Appreciable savings in time for replacing patterns would have resulted had the customers kept their drawings current.

The purchasing department resubmitted the original specifications for the building and placed a rush

Damage to plant required that it be partially torn down and rebuilt.

order with the steel fabricating companies. As the pattern drawings were revised, emergency orders were placed with pattern shops in three states.

All these suppliers responded by giving the orders a top priority. A representative of the builder was on the scene shortly after the fire was extinguished and worked closely with the foundry management to speed fabrication of the building and equipment.

To resume production at all, the 60 skilled foundry personnel would have to be available when production facilities were restored. A work schedule was established for using each employee a certain number of hours per week for plant renovation and equipment repair. A number of men were assigned production jobs at the Nelson Manufacturing plant. Temporary jobs in neighboring foundries were obtained for others.

Because of water damage, all plant production equipment had to be torn down, cleaned out, rebuilt, re-oiled and reassembled. A large part of the electrical equipment on the machines had to be torn out and rewired. About 1/4 of the production equipment, including the cranes, was a complete loss. The remainder had to be rebuilt. This renovation was done by the foundry maintenance crew and other employees.

Back in Production

On Sept. 25, 40 days after the fire, the foundry was in production once again. A 10-day delay caused by an acute shortage of structural steel prevented achieving the anticipated goal of thirty days. Additional production area was obtained in the new foundry by using the space formerly reserved for pattern storage. Patterns are now stored in a separate building nearby.

How it was Possible

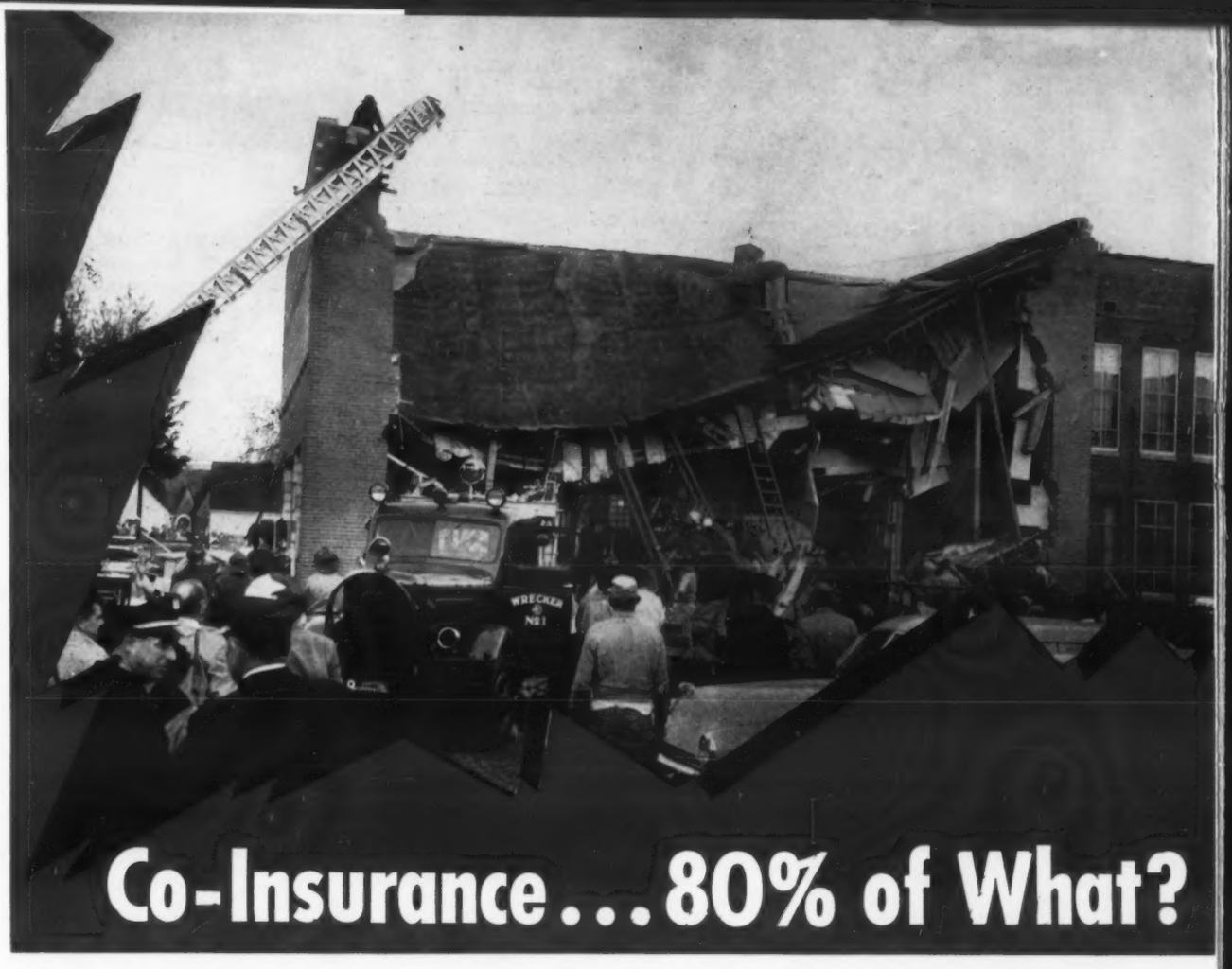
Regular customers did not experience any shortage of castings during the reconstruction period. The 30-day supply of castings, which the foundry maintained as an extra service to customers, escaped the fire.

A number of factors are credited with making it possible to resume production in such a short time. Some of these may help others prepare plans for meeting disaster.

- The speed with which the fire department answered the alarm and their action in protecting the undestroyed equipment.
- The prompt decision by management to rebuild the foundry in the same location and to use the same building plans.
- Availability of original drawings of building, equipment, and patterns.
- Prompt action by the engineering department in bringing the drawings up to date and by the purchasing department in immediately placing rush orders.
- Clearing the area and starting to salvage and rebuild equipment the day of the fire.
- Providing jobs for the skilled foundry personnel during the rebuilding period so they would be available when production resumed.
- Excellent cooperation of pattern shops, steel fabricators, and other suppliers in filling rush orders on an emergency basis.

Pattern storage in separate building gives rebuilt plant more space.

Six weeks after fire, NEMCO was operating in reconstructed building.



Co-Insurance . . . 80% of What?

KENYON D. LOVE / *Vice-President*
Colonial Foundry Co.
Louisville, Ky.

Attorney-foundryman sees flaws in co-insurance protection for metalcasting plants

Almost every insurance salesman will insist that **co-insurance is** the only thing to buy when insuring plant property. They rarely mention that there is something else. If you ask for something else, many will pretend ignorance of the subject. As a matter of fact, many probably are actually ignorant of the fact that you can buy straight insurance. Straight insurance is insurance without co-insurance.

The insurance discussed in this article is that which covers the usual fire, windstorm, extended coverage (which includes windstorm), vandalism and malicious mischief. If you ask your insurance agent about it, he will, if he is like many, give you all of the standard arguments in favor of co-insurance.

The most popular one is that co-insurance is cheaper. This statement is not necessarily true. Co-insurance can be more expensive. The rate is cheaper, but the premiums you will have to pay for co-insurance periodically will be greater than those you would have to pay for straight insurance.

Buying insurance is just like buying anything else. You buy a quantity at a certain price-per-unit. The more quantities you buy the greater the total invoiced price. If you had a choice, as foundrymen, to buy a molding sand binder that costs $0.60 per cwt of facing or one that costs $1.20 per cwt of facing you would know which you would prefer, all other things being equal.

If you were told that the first binder costs $1.00 per cwt of binder and that the second binder costs $1.10 per cwt of binder, you would not have enough information to go on, would you? You would immediately want to know how much of each binder would be required per cwt of facing sand to do the job.

In other words, in buying you can't decide the cost on the basis of price alone. This rule applies to insurance the same as to anything else. The questions involving insurance are complicated, of course, but what you get for the money when buying insurance is the purpose of this article.

What is Co-Insurance?

Everyone reading this article should know exactly what is meant when the terms "co-insurance" and "straight insurance" are used.

An attempt will be made to explain these terms in the language of foundrymen. If you bought co-insurance for a $100,000 building, you would be asked to insure the building for at least a certain percentage of its value. The usual percentages are 80 per cent and 90 per cent. If you should buy 80 per cent co-insurance, you would agree to pay premiums on $80,000. If the premium rate for 80 per cent co-insurance on that particular building was $2.00 per hundred dollars of insured value for the period of insurance, then the total premium would be $20 per thousand, or a total of $1600.

Now at this point you might ask the questions "What makes the building worth $100,000?" "Who decides this?". If you should get into a discussion with insurance men on this question, again you might find

continued on page 102

BE PREPARED: **The metalcasting industry is not immune to fire and natural disaster. Fires causing over $1,500,000 loss have been reported to the National Foundry Association since 1955. Floods ravaged New England foundries in 1955, an explosion ripped a Wisconsin plant in 1956, and a tornado damaged an Alabama foundry in 1957.**

PRODUCING CASTINGS for VITREOUS ENAMELING

C. A. SANDERS / *Vice-President*
American Colloid Co.
Chicago

R. E. WILKE / *General Metallurgist*
Plumbing & Heating Div.
American Radiator & Standard
Sanitary Corp.
Louisville, Ky.

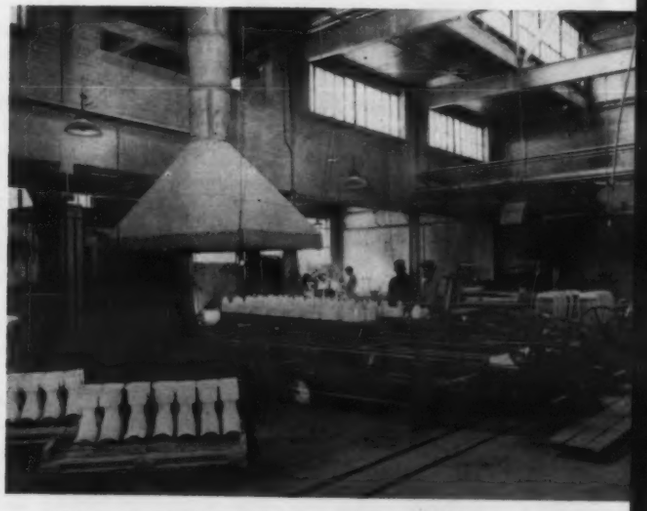
Craftsmanship is required at every stage of production to produce good enamelware castings

Enamelware foundries have been taught the use of finer, more silty naturally bonded sand with low bond content. This practice has become more hereditary than practical. The enamelware foundries as a rule have been side floor foundries, only the larger ones have been fully mechanized.

The enamelware foundries that produce light weight castings such as stove parts, heater parts, frames, restaurant accessories, etc. generally have limited capacity and realize that unless a certain amount of mechanization is available, the foundry cannot obtain the full economy from synthetic (compounded) sand mixtures.

CHICAGO HARDWARE FOUNDRY CO. PHOTOS

Craftsmanship is essential in production of enamelware.



Most enamelware castings are light weight.

SAND PRACTICES

Synthetic or semi-synthetic sands are coming into general use in enamelware foundries

Progressive foundrymen have learned the value of applied sand control but only recently has there been a trend toward the use of synthetic (compounded) or semi-synthetic mixtures in the enamelware industry.

Not all localities have suitable naturally bonded sands for enamelware, so the more desirable ones are imported from outside deposits. This additional freight expense and excessive handling costs have forced many foundries to seek relief by incorporating a more plentiful unbonded base sand in a semi-synthetic sand mixture.

■ **Naturally Bonded Sands.** Enamelware foundries have used the Albany sands, Tennessee sands, New Jersey sands and the Mississippi sands. A good selection of fineness and clay content can be obtained with these sands to produce excellent casting finish when they are properly controlled.

Most of these fine grained sands are considered weak sands and require substantial new sand additions in the system to obtain the standard mechanical properties needed for good molding.

Unfortunately the durability of these sands are not good in most cases and it is expensive to add 100 lb of a natural sand in order to obtain 12 per cent by weight bonding clay.

The fear always exists in an enamelware foundry that these fine grained naturally bonded sands will "ball-up" due to their acceptance for high moisture content.

Many arguments may be proclaimed for the use of naturally bonded sands, if they are received with uniform sieve analysis, clay content and moisture. If chemical composition varies to a great degree, fusion may occur and excess cleaning costs develop. The blending of unbonded sands with a carefully selected clay additive is gaining momentum. Enamelware foundries are reducing costs by utilizing local unbonded sand.

Actually, enamelware castings

that are to be coated with a fired fritted glaze or enamel need not be smooth. Many state that better adherence is obtained by applying enamel coating against a rougher finish.

■ **Semi-synthetic (compounded) Mixtures.** Molding sands that are properly tempered, bonded, mulled and aerated have been most successful in outdoing some of the better grades of naturally bonded sand.

Expansion defects have always been associated with flat enamelware castings and appear as rattails, buckles or scabs when loss of sand control occurs. The semi-synthetic sand mixtures were developed to overcome these complaints. But the sand mixture must be closely associated with the type and degree of ramming in order to be effective.

The semi-synthetic mixtures which contain part naturally bonded sand have the smooth velvet "feel" that indicates better workability.

A typical semi-synthetic (compounded) sand mixture which has worked well on light enamelware castings and thin sectioned castings follows:

25 lb lightly bonded naturally bonded sand, AFS gfn 250 (approximately), clay content no more than 12 per cent by weight.
75 lb unbonded silica sand, AFS gfn 90-120, less than 1 per cent clay content.
2 lb southern bentonite
4-6 pints of water per 100 lb of sand.
Mulling time not less than 3 min with a heavy slow speed muller and not less than 90 seconds with a high speed muller.

The finer grades of sand mentioned in the above formula have a most important effect on the mechanical properties of the mixture. The fine grades of sand, usually have a 4 or 5 screen distribution. These fine sands may close the mixture rapidly but the detail of the casting finish is excellent.

The above formula may have less than 10 permeability but produces satisfactory results. The green compression strength may be worked under 8 psi if desired, or it may be advanced to as much as 15 psi with equal results.

Location of the foundry determines the choice of sands selected but the nearest, finest, and driest received from the best available source is recommended.

A semi-synthetic sand mixture which has worked well at one foundry has the following formula:

40 lb fine bonded grade Albany sand, Tennessee sand, New Jersey sand or Mississippi sand. The grade selected depends upon choice of finish desired. Clay content under 15 per cent.
60 lb unbonded silica sand, or specially washed sands from several suppliers, AFS gfn 115 to 150, clay content not to exceed 5 per cent.
2 lb southern bentonite
1/2 lb of wood flour, no more than 5 per cent retained on a No. 50 sieve, not a preponderance of fines through No. 200 sieve.
5-6 pints of water maximum. Mulling time not less than 3 min with a heavy slow speed muller and not less than 90 seconds with a high speed muller.

This formula may work well in most enamelware foundries. If a number of deep pockets or lifts occur, it is recommended that either 1 lb of western bentonite be added to the above formula, or western bentonite may be substituted entirely for southern in the above formula.

If mold edges seem to be too brittle add 1/8 to 1/4 lb of corn flour or cereal, directly to the above formula.

■ **Synthetic (compounded) Mixtures.** A few enamelware foundries have gone entirely to synthetic (compounded) sand mixtures but it is believed a semi-synthetic mixture is more satisfactory. Straight synthetic mixtures usually contain a high bond addition of fire clay, western bentonite, or southern bentonite. The clay may vary from 8 per cent to as much as 15 per cent but the temper water is usually less than 4 per cent. The mulling time is shorter but aerating is very intense. A cellulose additive such as wood flour is commonly put in these high bonded sands to help maintain a satisfactory shakeout.

These sands work well in a slinger operation, contrary to the recognized fact that a lightly bonded naturally bonded sand with 6 per cent moisture content is best for slingers. These high bonded, short mulled and low moisture sand systems are recognized as an advancement in foundry technology.

■ **Additives.** Wood flour is added to overcome certain volume changes in the sand molds, thus eliminating buckles, rattails or expansion scabs. It tends to overcome problems associated with excess ramming or sand distribution or too few sieves. Wood flour reduces expansion defects arising from uneven ramming. Wood flour improves shakeout and helps eliminate baked sand in deep pockets.

Carbon additions in the form of seacoal, pitch, or other materials cause castings to be more difficult to enamel. Such enamel defects as "copperheads", "blisters", "pinholes" or other gas defects may occur.

Kerosene or fuel oil is added by a few enamelware foundries. Approximately 1 pint of kerosene or light fuel oil per 1,000 pounds of molding sand will prevent drying out and eliminate brittleness. This is not always recommended as additional mold gas is created.

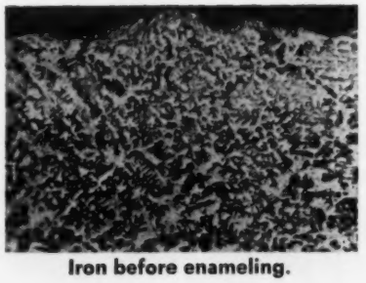
METALLURGY

Casting design and metal composition are sharply reflected in the ultimate enameled product

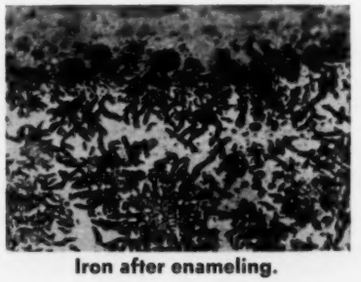
. . . The successful enameling of a casting begins at the design board. The draftsman that creates a poorly designed casting may cost the company time and money in attempting to pass this casting through the enamel department.

The design engineer should do everything possible to avoid sharp corners or edges. Not only is such a casting difficult to mold and cast but it is equally difficult to enamel. Slight radii and even curves should be considered by designing smooth flow lines into the casting. If the casting carries ornamental or decorative design, then the protruding edges should be smooth with no abrupt changes.

Avoid cored holes if possible and try to maintain uniform section thickness, as extreme differences



Iron before enameling.



Iron after enameling.

lead to loss in the foundry and enamel department.

■ **Composition of Metal . . .** It is claimed that the best enamel iron contains between 3.4-3.8 per cent carbon, as high as 2.6-3.0 per cent silicon, manganese approximately 0.50 per cent, phosphorus 0.8 per cent, and sulphur below 0.10 per cent. Some feel enamel iron should contain a carbon plus silicon content over 6 per cent to make it satisfactory for enamel and iron to properly bond.

The exact silicon content is usually governed by the section of the casting and the fluidity or hardness desired. As casting section increases, lower silicon content may be used. Iron with high sulphur combined with high manganese is difficult to enamel. This composition is susceptible to hard spots, develops a hard skin and is difficult to flow in the mold.

Some investigators feel that proper casting density can be maintained with manganese content as high as 0.60 to 0.70 per cent.

If the iron contains too much sulphur, the skin of the casting is very hard and machining most difficult. It has been claimed that ferrous sulphate can be formed on the surface. The compound easily erupts into small pinholes and develops a boiling action of the enamel after it has been applied to the iron and fired. This eruption creates small blow-holes which may not seal properly after erupting.

It has been further claimed that enamel peels from iron when sulphur content exceeds 0.12 per cent. All castings with a high sulphur content should be annealed until no further decomposition occurs.

Even this treatment does not always correct the difficulty. At least four times the amount of manganese is required to compensate for the sulphur, but the sulphur content must remain below 0.10 points in order to insure against peeling. If a large amount of remelt is being used instead of pig iron or steel scrap, sulphur and manganese build up in the system. Should the returns and re-melts be on the high side, sulphur and manganese will continue to circulate with each re-melting and gradually climb beyond a safe and satisfactory level.

■ **Impurities in the Charge or Ladle Addition.** It is claimed that aluminum and chrome are bad for enamel iron castings. Certain ferroalloys may contain enough residual aluminum to contribute to difficulties that are not good for enameling practice. Particularly is this true if a plant is attempting to increase the silicon solely by ladle additions. Any non-ferrous tramp metals entering the cupola tend to promote trouble and should be avoided by all means. Two of the worst offenders mixed into enamel cast iron are antimony and tin.

■ **Oxidized Iron.** An oxidized iron is not suitable for good enamel practice and should definitely be avoided. High blast at the cupola, wet ladles, wet refractory linings and particularly wet spouts can produce an oxidized iron. Interrupted pouring and botting of the cupola may also produce oxidized iron.

Therefore, hot metal in contact with moisture in any form is dangerous. Some monolithic cupola linings containing excess water may contribute to oxidized metal.

Excess coke is often recommended to insure hot metal and to minimize oxidation.

Cold metal as well as too fast a shakeout can produce hard iron. It is recommended that metal be poured as hot as possible to insure better enameling.

■ **Microstructure of Cast Iron for Enameling.** Enamel grades of cast iron should not necessarily present the same structure as machine quality iron. Pearlitic structure may be the best for machinability but it is the most unsuitable structure for enameling-quality cast iron. Cast iron undergoes a change of structure during the enameling process, and, as in the case of full annealing, a ferrite-graphite structure replaces much of the pearlite.

The structure should be practically all ferrite and finely divided graphite, in the characteristic "whorl" formation. If cementite is present in a 1 in. square test section, it is quite likely the castings will be unfit for enameling. The castings themselves should normally show about 0.5-0.6 per cent combined carbon with the balance of carbon in form of graphite.

Because of the elevated temperature instability of pearlite enamelware foundries perfer to apply enamel to a ferritic cast iron.

The change from a pearlite to ferritic structure is further complicated by the emission of a certain quantity of gas, which must escape through the viscous enamel. In doing so it can easily force the enamel away from the metal surface and cause a defect. This is one of the strongest reasons why shops prefer to enamel a casting after it has been subjected to an annealing treatment.

It is claimed that an enamel tends to cling to ferritic iron because the graphite flakes on the surface of the casting act as little bonding points.

■ **Slag Control.** To see how the cupola is functioning, it is recommended that the operator continually watch the slag and its color. If considerable slag wool is formed, it means hot melting and the danger of oxidized metal. If the slag is green, solid and glassy, it indicates good melting practice.

A light brown, glassy slag with yellow tinge can mean good melting practice, but the manganese may be on the high side. This slag warns that small castings may become hard.

Deep brown to black and solid slag indicates large quantities of iron oxide present. Oxidized iron is susceptible to misruns or cold shuts common to stove castings.

A black-brownish slag, or a froth slag, indicates excessive oxidation. Unless the bed is raised, additional coke added, and the blast lowered, over-oxidation will lead to hard iron, pinholes, cold shuts, and other defects.

The quickest way to eliminate the black or brown slag is to increase the coke and limestone. If too much limestone is added the slag becomes dull with a stony fracture. Then of course the lime should be reduced. Excess lime may cut the cupola lining rapidly. A white slag definitely shows that the limestone is cutting the lining and bridging may result. A slag which is purple to black and very solid in fracture denotes high sulphur, or that the slag has been desulphurized. Metal shot in slag indicates too high a blast and cold melting may result.

With reduced operations, the oxidation of molten iron by the use of excessive air can readily be detected since the slag turns black. Large quantities of rusty scrap also make the slag black, but in either case the iron oxide in the slag causes greater lining erosion.

Analyze Cupola Operation by Watching Condition and Color of Slag

SLAG APPEARANCE	MELTING CONDITION
▪ Green, solid, glassy	▪ Good melting practice
▪ Light brown with yellow tinge	▪ Good practice, but manganese may be high
▪ Slag wool in excessive amount	▪ Hot melting, danger of oxidizing metal
▪ Deep brown to black, solid	▪ Large quantities of iron oxide present
▪ Black-brown or frothy slag	▪ Excessive oxidation

ANNEALING PRACTICES

Continued from page 37

Annealing and cleaning practices are vital in producing cast enamelware

After the gates, risers, and sprues have been removed and the castings have passed through the grinding operation to smooth the rough edges, they are ready for the annealing or cleaning room.

It is often considered good practice to anneal the castings to be enameled in order to relieve strains and stresses developed during the solidification of the casting in the mold.

As stated previously, this heat treatment further releases some of the gases entrapped in the metal and also breaks down pearlite to ferrite and graphite. The annealing may be confined between the ranges of 1470 F to 1560 F. A muffle furnace is best for this annealing operation because there is less chance of gases being absorbed by the castings. Loose molding sand is also removed in some annealing operations.

After the heat treatment, the castings are ready for shot or sand blasting. Modern enamel plants accept castings that have been shot blasted. There are still many who prefer sand blasted castings as they claim better surfaces are obtained and the enameled castings in general have less defects than when metal shot is used.

■ **Enameling Cast Iron.** Reliable frit suppliers should be consulted regularly with any unusual problems. Enamel is individually selected for each type of cast iron. The peak temperature and burning time depends on the raw materials of the fritted enamel selected. The individual castings, weight of the furnace load, type of furnace, and fuel must be considered in a recommendation.

Almost all cast iron enamel undergoes a certain amount of blistering at the time the enamel begins to fuse. These blisters break and the enamel flows and heals before the maturing temperature is reached. There is a rule in the enamel plant that the first coat of enamel on a casting should be burned hard, but this does not mean over-burning.

Enamel applied too heavily is difficult to fire properly. Enamel which has been sprayed too heavily tends to blister more in the firing than enamel which has been sprayed properly.

If the furnace temperature is too high, there is danger of overburning the enamel. This is particularly true of castings unequal in thickness.

■ **Sulphur Scum.** It has been stated previously that sulphur in the metal produces enamel difficulties but high sulphur fuel used in the enameling furnace can also be troublesome.

At times, sulphur scum develops from the sulphide content of an oxide which is being used to color the enamel. In such cases, the coat of enamel with a high sulphide content should be burned first and other colors of enamel burned subsequently.

■ **Conclusions.** The craftsmanship of each department should be used to the fullest advantage of producing good enameled castings.

A closer understanding must be developed, as it is believed that one department can help the other if the overall problems are clearly and openly discussed.

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1958 Transactions Preview

Gases in Cast Iron With Special Reference to Pickup of Hydrogen in Sand Molds

by J. V. DAWSON *and* L. W. L. SMITH .....*p 39*

British investigators report efforts to correlate hydrogen pickup from sand molds with pinhole defects.

Observations on Pinhole Defects in White Iron Castings

by R. W. HEINE .....*p 53*

This study summarizes some basic causes of pinholing, related foundry variables, and possible remedies.

The Theoretical Concepts of the Packing of Small Particles

by J. B. CAINE *and* DR. C. E. MCQUISTON .....*p 58*

Explains how the production of sand molds and cores is based on laws governing the compaction of small particles.

Density of Sand Grain Fractions of the A.F.S. Sieve Analysis

by R. W. HEINE *and* T. W. SEATON .....*p 62*

Effects of ramming, jolting, and vibration on the density of various sieve fractions is reported.

Improving Electric Furnace Refractory Life by Special Shell Cooling Techniques

by VERNON J. HOWARD .....*p 68*

This study shows how a water cooling system increased refractory life in an electric furnace.

AMERICAN FOUNDRYMEN'S SOCIETY – PREPRINT NO. 58-7
This paper has been approved for presentation at the 62nd Annual Meeting of the American Foundrymen's Society, to be held in Cleveland, Ohio, May 19-23, 1958. The Society reserves all rights for publication either prior to or subsequent to presentation, and is not responsible for statements or opinions advanced herein.
WRITTEN DISCUSSION IS SOLICITED

GASES IN CAST IRON WITH SPECIAL REFERENCE TO PICKUP OF HYDROGEN IN SAND MOLDS

AN ACCOUNT OF RECENT WORK AND THE VIEWS OF BRITISH INVESTIGATORS

By
J. V. Dawson* and L. W. L. Smith*

The determination of the gases oxygen, hydrogen and nitrogen in cast irons presents a difficult problem, but in recent years suitable techniques have been developed for this purpose.[1, 2, 3] Not the least among the problems is the provision of a suitable sample, but it has been shown that a small cylinder, chill-cast in a graphite mold, gives most reproducible results and is convenient to handle.[1, 2] This sample is not ideal for hydrogen determinations because of loss of hydrogen during cooling, but the results are suitable for comparison. Tests have shown that the loss of hydrogen is small particularly when the total hydrogen content is low.

Metal has been sampled at a number of diverse plants covering a wide range of melting units and compositions. Oxygen contents ranged between 4 and 100 ppm, nitrogen between 15 and 140 ppm, and hydrogen between 0.8 and 2.7 ppm in normal, unalloyed irons. These hydrogen figures may be slightly low due to the sampling method employed at the time.

In the British Cast Iron Research Association's laboratories a considerable amount of information on the effects of gases in cast iron has been obtained and a resume' of the major points follows.

Nitrogen[5]

The addition of compounds such as ferro-cyanides, or ammonium compounds to the liquid metal gives considerable increases in nitrogen content. Nitrogen is a carbide stabilizer promoting the retention of eutectic carbide and pearlite in the as-cast structures and rendering these constituents more difficult to decompose by annealing. Large additions of nitrogen can cause porosity to occur, but the amounts required are considerably greater than any found in commercial cast iron.

Aluminum and titanium have a strong affinity for nitrogen and form very stable nitrides.[6] Small additions of these elements to the liquid iron neutralize all the effects of nitrogen. The carbide-stabilizing influence of nitrogen and its neutralization by aluminum and titanium is demonstrated here for malleable iron.

In the absence of aluminum and titanium the time required to complete the first-stage anneal was increased from 12 hr at 70 ppm nitrogen to 25 hr at 185 ppm. There was a corresponding increase in the time for second-stage anneal from 27 to 85 hr. The additions of 0.01 per cent aluminum at 185 ppm nitrogen or 0.02 per cent aluminum at 240 ppm nitrogen produced irons annealing almost as rapidly as the untreated material. Similarly the addition of 0.03 per cent titanium at 180 ppm nitrogen gave an iron annealing more rapidly than at 70 ppm nitrogen with no titanium addition, while at 255 ppm nitrogen not much longer was required than for the untreated samples.

Oxygen

It is very difficult to increase the oxygen content of cast iron to any extent. Plunging large quantities of iron oxide into a ladle of metal or bubbling oxygen through it results in an increase in the oxygen content from perhaps 10 to 100 ppm in a low-silicon iron (0.5 per cent). Even so the oxygen content will fall within minutes to perhaps half this figure. Smaller increases are obtained as the silicon content is raised. From the limited thermodynamic data available it is understandable that the oxygen content should be low in view of the large amounts of carbon and silicon present.

In considering the effects of oxygen, confusion can arise from relating the effects of "deoxidizer" additions to the removal of available oxygen from the melt rather than to the addition of the element itself. Unless it can be shown that a change in oxygen content, in the absence of other composition changes, produces a carbide-stabilizing effect, it is not advisable to attrib-

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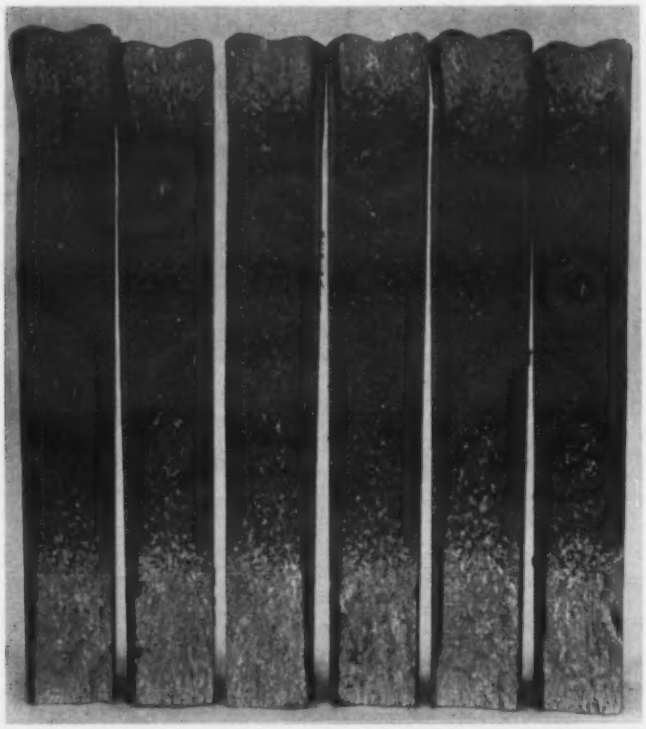

Fig. 1—The effect of oxygen on chill depth. No aluminum.

ute a stabilizing effect to oxygen on the grounds that a small addition of, say, aluminum produces a graphitizing effect, particularly when additions larger than those required to combine with the oxygen continue to have the same effect. Losses of silicon and carbon occur when large quantities of oxide are added to cast iron, and these will have a stabilizing effect.

The fractures of a set of chill blocks with oxygen contents ranging from 10 to 80 ppm are shown in Fig. 1. Considering the relatively large increase in oxygen content, it has had no marked effect, particularly as a small loss of silicon occurred through the series.

When a deoxidizer is first added, however, the oxide addition has a marked effect on chill depth. The fractures shown in Fig. 2 are (left to right) from untreated iron, after 0.01 per cent aluminum added in the furnace and increasing ladle additions of oxide to give a maximum oxygen content of 70 ppm. The initial decrease in chill depth produced by the aluminum is removed as the oxygen content is increased. Without the knowledge that aluminum was present this experiment would suggest that oxygen (or the addition of iron oxide) has a chilling tendency.

Similarly, increasing the oxygen content of a malleable iron from 15 to 110 ppm had no effect on its annealability.[8] After an initial addition of 0.01 per cent aluminum, subsequent oxide treatments removed the graphitizing effect of the aluminum to give an apparent carbide-stabilizing effect due to oxygen.

Other trace elements might be expected to give different apparent effects, dependent upon the properties they normally confer.

Hydrogen

Cast iron usually contains between 1 and 2 ppm of hydrogen. The presence of moisture in any of the refractory materials used in the foundry will tend to raise this hydrogen content. For instance, in the first few taps from a cupola, after fettling and patching, hydrogen contents as high as 3.5 ppm have been recorded, while later taps from the same blow have contained only 1.2 ppm hydrogen. Similarly, there is usually little difference in the hydrogen content of a sample taken direct from the furnace spout and one taken from a well used and dried ladle filled at the same time. But, if the ladle used has been patched or allowed to become damp, as much as 100 per cent increase in hydrogen content may occur.

The hydrogen content of molten iron may be deliberately raised by bubbling hydrogen through the metal or by holding a plunger filled with damp sand below the surface of the metal. Bubbling a dry gas such as argon or carbon dioxide will reduce the hydrogen content to some extent, although some precautions must be taken to prevent the metal splashing up into the moist air above the surface and thus picking up as much hydrogen as it is losing to the scavenger gas.

In normal flake-graphite irons the variations in hydrogen content of the liquid iron met with in normal foundry practice do not appear to have any significant effect except that, very occasionally, gross blow-holes can occur from high hydrogen contents.

Dawson *et al*[9] have considered a specialized case in which titanium is added in order to produce undercooled graphite structures. High hydrogen contents prevent this formation of undercooled graphite and the removal of hydrogen by bubbling dry gas gives under-cooled graphite again.

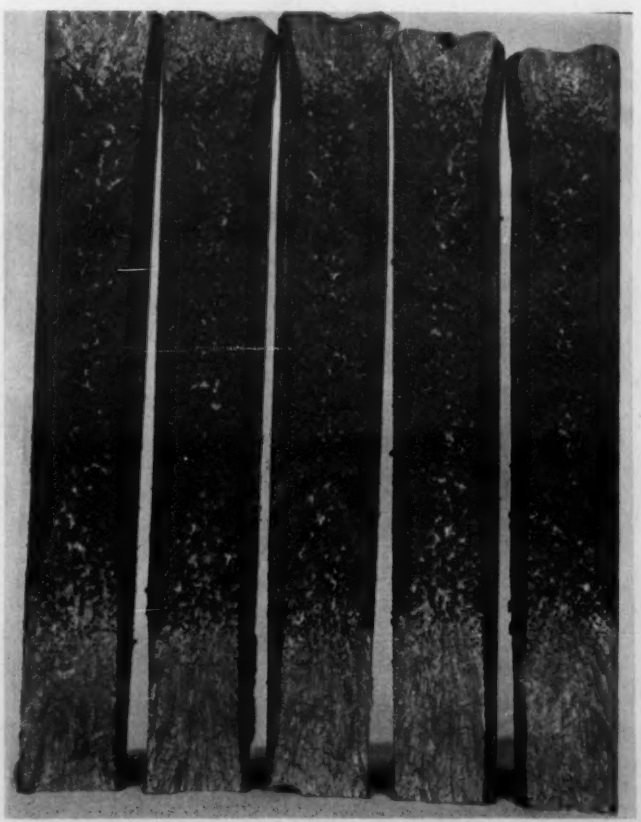

Fig. 2—The effect of oxygen on chill depth. 0.01% aluminum.

Hydrogen Pickup from Sand Mold

So far no reference has been made to the most important factor of all, that is, the sand mold.

As the hydrogen content can be raised by plunging damp sand into the liquid iron it seems reasonable to expect this to occur when the metal is cast into a sand mold. The hydrogen pickup occurs from the reduction of water vapor by the iron and various elements dissolved in the iron.

A sand mold has been designed in which the liquid metal can be sampled after passing over sand. This consists of a down-runner leading to a horizontal channel 17 in. long by ½-in. deep by 1¼-in. wide, terminating in a small boss with an overflow hole cut from the far side. Metal, after passing along the channel, can be collected in a chill mold placed underneath the overflow hole. For each test a sample of metal is taken straight from the ladle in another chill mold. The difference between the hydrogen contents of the two samples gives an indication of the metals tendency to pickup hydrogen from this particular mold. Obviously, no absolute figure can be obtained because of the infinite variations in mold design, but the figures are comparable.

During preliminary tests with this mold a number of types of iron were sampled after pouring through green (5 per cent H_2O) and dry sand molds. Normal black sand (i.e., with coal dust) was used and the dry molds were oven dried overnight. The results are summarized in Table 1.

There is a definite pickup after pouring through sand molds, and this is greater in green sand than in dry sand molds. A high manganese austenitic iron picked up very much more hydrogen than did the other irons.

PINHOLE DEFECT AND ITS RELATION TO HYDROGEN PICKUP

Pinholing consists of a layer of small blowholes situated just below the casting skin. They are often only revealed by heavy shot-blasting or skin-machining.

Pinholes probably arise from various causes in different materials, but it is those which occur in flake and nodular graphite cast irons which will be discussed here.

Gittus[10] has suggested that magnesium is the cause of pinholing in nodular castings, and showed that additions of bismuth or tellurium or more than 0.2 per cent aluminum prevented pinholing. The addition of 6 per cent coal dust or 2 per cent pitch to the sand also minimized the pinholing tendency.

Appearance of Pinholes

Close examination of the defect when seen on a fractured face reveals the presence of a continuous graphite film on the surface of the holes. Examples of this are shown in Figs. 3 and 4, which show pinholes broken open. In some cases the film of graphite has been pulled out of the other half of the pinhole and remains as a thin-walled graphite "bag" in the half shown.

SIGNIFICANCE OF GRAPHITE FILMS

Bernstein[11] found that a film of graphite formed on the surface of white iron heated to 1000 C in pure dry hydrogen, even though no other graphitization took place. The present authors have found that this occurs when white iron is annealed in pure argon or in vacuum with normal graphitization also taking place. Figure 5 shows the edge of a sample annealed in argon.

Similarly, when a cast iron ingot is melted and cooled in high vacuum a film of graphite forms rapidly on the surface just prior to, or during the solidification of the eutectic. When viewed under the microscope this film is divided by a series of grain boundries or cracks in a general hexagonal pattern. The graphite appears to be arranged with its basal plain parallel to the surface of the ingot, giving specular reflection as shown in Fig. 6.

A similar pattern is found on the graphite found in pinholes, although sometimes it is obscured by a more prominent pattern of concentric rings.

The important point arising from these observations is that the gas contained in the pinhole is likely to be of an inert or reducing nature. Blowholes caused by excess hydrogen frequently are coated with graphite and have bright, shiny surfaces.

From this somewhat tenuous reasoning it was thought that pinholes may arise from a liberation of hydrogen near the surface of a casting just as the casting skin is formed, this hydrogen arising from a mold/metal reaction. The following series of experiments were carried out to some extent to investigate this. The melts were carried out in oil-fired crucible furnaces using salamander crucibles. A standard pinhole test piece was used, consisting of a series of small plates of various thicknesses cast as shown in Fig. 7. These plates were all shot-blasted for 20 min before examining for pinholes.

TABLE 1 – PRELIMINARY TESTS

Metal Composition, %						Hydrogen, ppm*				
T.C.	Si	Mn	S	P	Ni	Before Casting	After Green Sand	After Dry Sand	Pickup in Green Sand	Pickup in Dry Sand
3.1	1.8	0.5	0.01	0.02	–	1.0	2.3	–	1.3	–
2.8	1.0	0.6	0.08	0.06	–	(1.0	1.7	1.4	0.7	0.4
						(1.2	1.8	1.6	0.6	0.4
3.2	0.8	0.6	0.07	0.02	–	1.0	1.8	–	0.8	–
3.4	2.4	7.2	0.03	0.47	9.4	1.7	4.9	–	3.2	–
3.3	2.2	6.9	0.02	0.49	9.3	1.9	5.1	3.8	3.2	1.9

* parts per million. 100 ppm = 0.01 per cent.

Effect of Manganese

In Experiment 1, overflow molds and pinhole plates were cast in normal black sand (+6% coal dust and 5% H_2O) and in red sand (+5% H_2O) from a series of taps with increasing manganese contents up to 4.5 per cent manganese. The chemical analyses are given in Table 2 and the red sand hydrogen results in Table 3 and Fig. 8. These show that extremely high hydrogen pickup occurs with high manganese contents.

Fairly severe pinholing occurred in the plates with manganese contents over 3 per cent cast in red sand but only very slight pinholing occurred in black sand. The ¼-in. plates cast in red and black sand are shown in Fig. 9.

TABLE 2 – CHEMICAL ANALYSIS OF MELT 1

	Composition, %				
Tap No.	T.C.	Si	Mn	S	P
1a	3.11	2.30	0.58	0.015	0.58
1b	–	2.30	1.44	–	–
1c	–	2.26	2.24	–	–
1d	–	2.23	3.00	–	–
1e	–	2.22	3.68	–	–
1f	3.22	2.19	4.41	0.019	0.58

Fig. 3–Graphite films in pinholes. ×20.

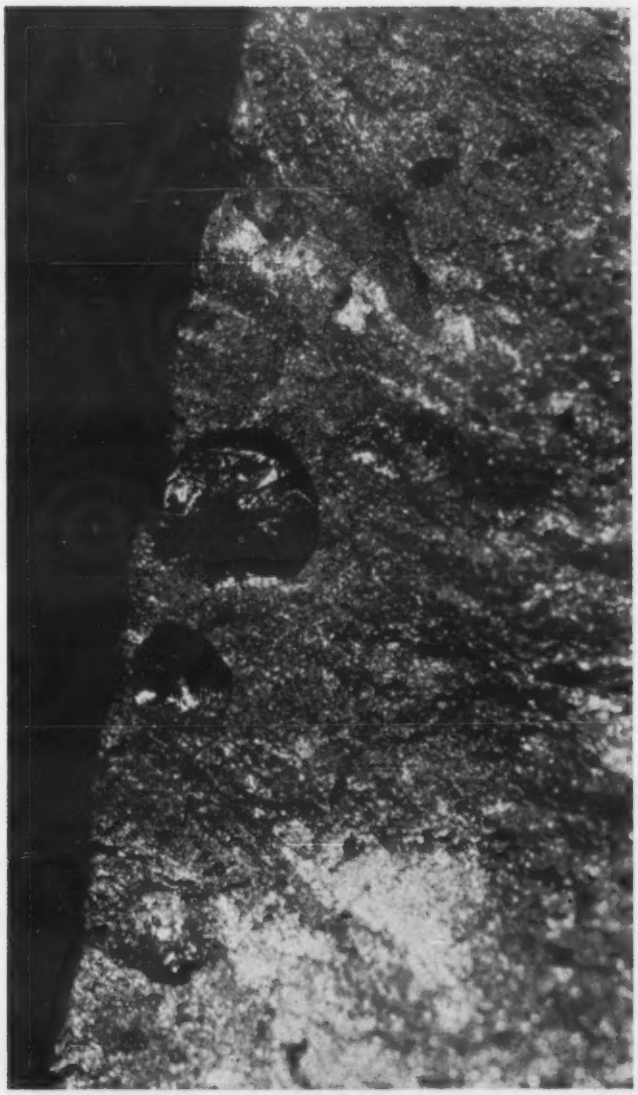

Fig. 4–Graphite films in pinholes. ×20.

Effect of Aluminum

The association of pinholing with the presence of aluminum has long been suspected. The analyses of a series of hematite-base irons with increasing additions of aluminum up to 0.2 per cent aluminum are given in Table 4 (Experiment 2). Hydrogen pickup figures in red and black sand are shown in Table 5, and plotted in Fig. 10.

The great increase in hydrogen pickup with as little as 0.01 per cent aluminum is remarkable, and this increase continues up to 0.04 per cent aluminum. Above 0.1 per cent the pickup begins to fall again. In general, black sand gave slightly higher pickup

TABLE 3 – HYDROGEN PICKUP IN MELT 1

Tap No.	Mn, %	Hydrogen, ppm
		Pickup in Black Sand
1a	0.58	0.36
1b	1.44	1.21
1c	2.24	2.83
1d	3.00	4.21
1e	3.68	6.18
1f	4.41	5.96

Fig. 5—Graphite film on the edge of an argon-annealed sample. ×500.

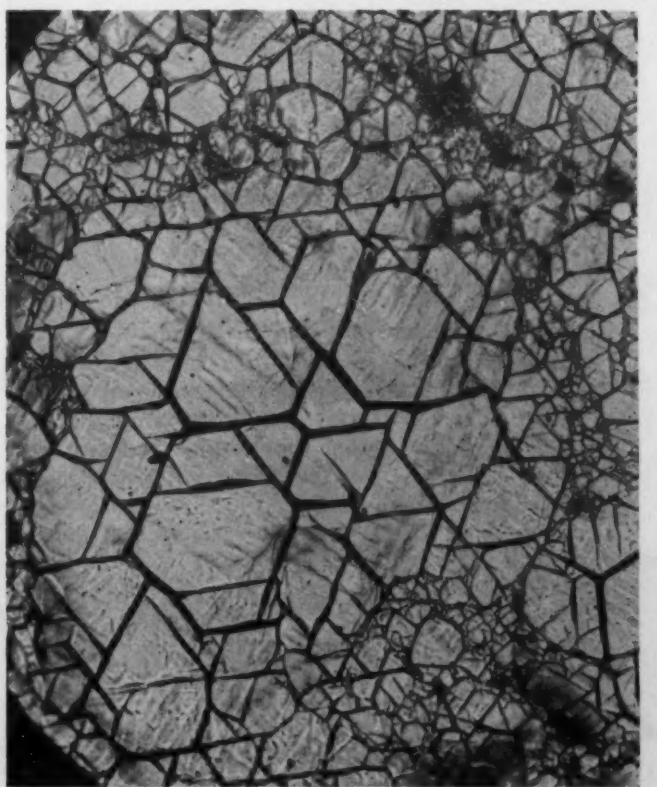

Fig. 6—Surface film of graphite on a vacuum melted ingot. ×100.

than red sand. Severe pinholing occurred in the thin plates cast in red sand from metal with aluminum contents between 0.01 and 0.10 per cent. The 3/16-in. plates cast in red sand with no aluminum and 0.10 per cent aluminum are shown in Fig. 11. No pinholing

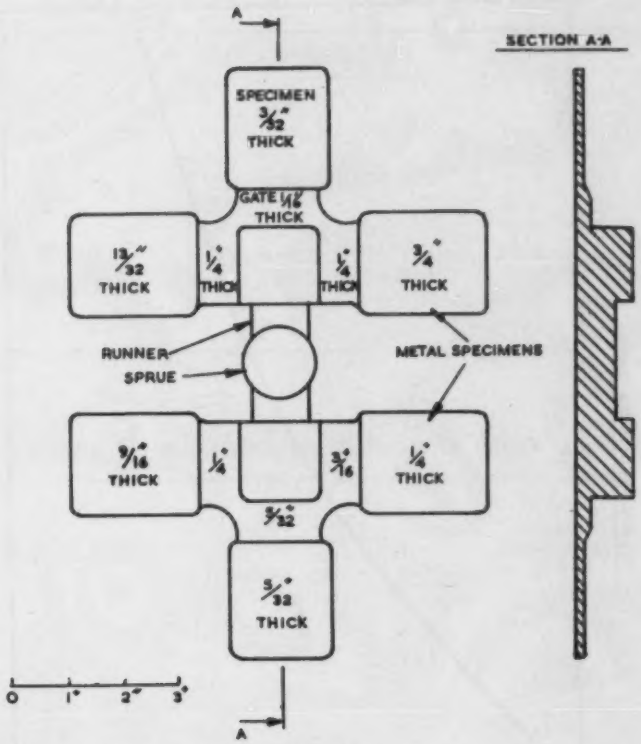

Fig. 7—Pattern of pinhole test piece.

occurred in the black-sand castings. This is contrary to what would be expected from the hydrogen pick-up figures.

Effect of Titanium

Swedish charcoal iron was used in place of hematite pig in Experiment 3, which was otherwise a repeat of Experiment 2. The chemical analyses are given in Table 6 and the hydrogen figures in Table 7 and Fig. 12. These results are the same as from the previous test but this time no pinholing occurred in any plates.

The major difference between the analyses in the

TABLE 4 – CHEMICAL ANALYSES OF MELT 2

Tap No.	Composition, %						
	T.C.	Si	Mn	S	P	Ti	Al
2a	3.45	2.50	0.52	0.025	0.65	0.10	N.D.
2b	–	2.52	0.51	–	–	0.10	0.01
2c	–	2.59	0.51	–	–	0.10	0.04
2d	–	2.60	0.51	–	–	0.09	0.10
2e	–	2.50	0.51	–	–	0.09	0.20

N.D. = not detected.

TABLE 5 – HYDROGEN PICKUP IN MELT 2

Tap No.	Aluminum content, %	Hydrogen, ppm	
		Pickup in Green Red Sand	Pickup in Green Black Sand
2a	Nil	0.20	0.32
2b	0.01	1.58	1.77
2c	0.04	1.64	2.48
2d	0.10	2.08	2.53
2e	0.20	1.50	1.50

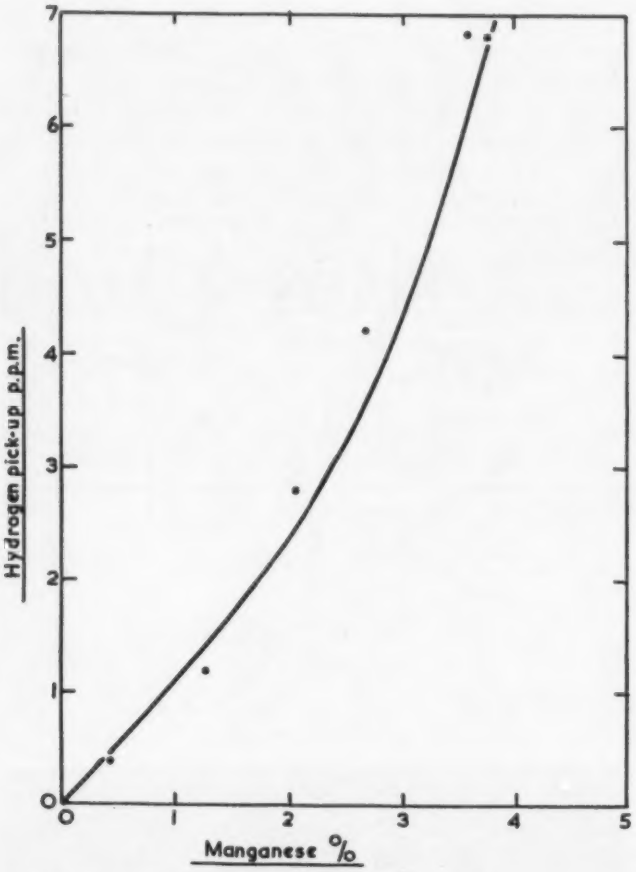

Fig. 8—Effect of manganese on hydrogen pickup.

two experiments was in titanium content. Experiment 4 was based on Swedish iron and a series of titanium additions were made. Two aluminum additions were also made, one with and one without titanium. The chemical analysis are given in Table 8 and the hydrogen figures in Table 9 and Fig. 13. Titanium did not significantly affect the hydrogen pickup but pinholing only occurred in the metal which contained titanium and aluminum.

In order to show quantitatively the amount of titanium required to enable aluminum to give pinholing, Experiment 5 had increasing additions of titanium in the presence of a constant addition of aluminum. The chemical analyses are given in Table 10 and the hydrogen figures for red sand in Table 11 and Fig. 14.

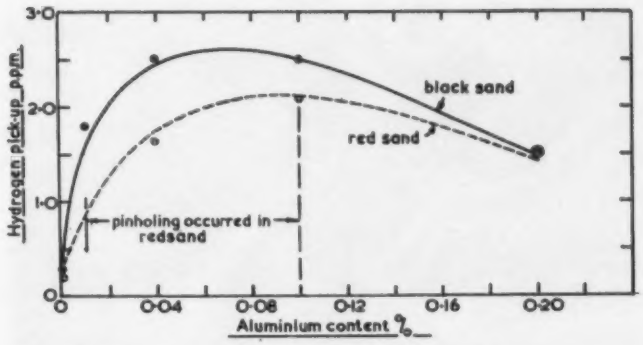

Fig. 10—The effect of aluminum on hydrogen pickup.

TABLE 6 – CHEMICAL ANALYSES OF MELT 3

	Composition, %						
Tap No.	T.C.	Si	Mn	S	P	Al	Ti
3a	3.47	2.59	0.48	0.015	0.59	N.D.	0.015
3b	–	2.52	0.48	–	–	<0.01	0.015
3c	–	2.56	0.47	–	–	0.015	0.015
3d	–	2.63	0.49	–	–	0.10	0.015
3e	–	2.56	0.48	–	–	0.15	0.015
3f	3.49	2.51	0.47	0.012	0.60	0.20	0.015

N.D. = not detected.

TABLE 7–HYDROGEN PICKUP IN MELT 3

		Hydrogen, ppm,	
Tap No.	Al, %	Pickup in Red Sand	Pickup in Black Sand
3a	N.D.	0.26	0.39
3b	<0.01	0.97	1.24
3c	0.015	1.41	2.02
3d	0.10	1.67	2.26
3e	0.15	1.36	2.06
3f	0.20	0.95	1.63

N.D. = not detected

Again titanium has had very little influence on the hydrogen pickup. No pinholing occurred in the presence of aluminum when the titanium content was less than 0.02 per cent, but severe pinholing occurred from the aluminum when the titanium content was more than 0.02 per cent. The ¼-in. plates cast in red sand are shown in Fig. 15.

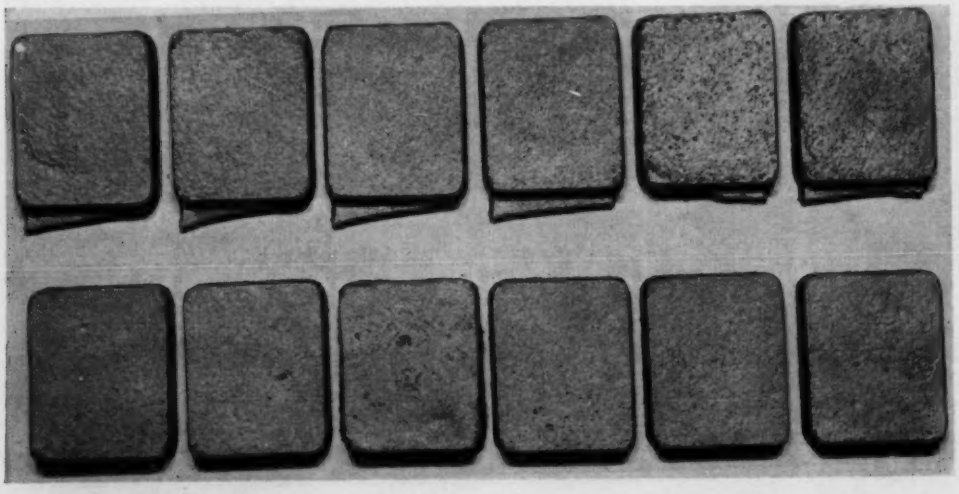

Fig. 9—The effect of manganese on pinholing in red sand (top) and black sand.

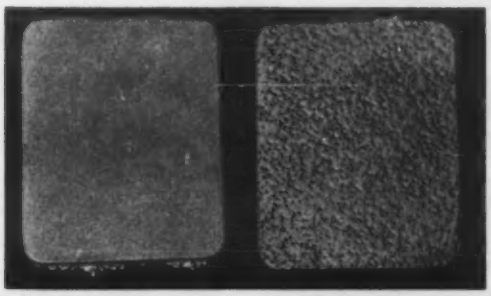

Fig. 11—Pinholing due to aluminum.

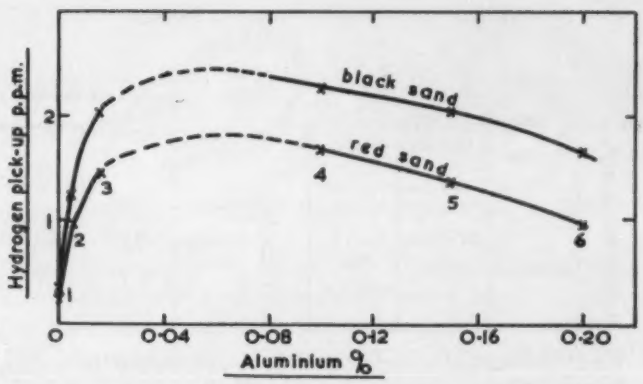

Fig. 12—Effect of aluminum on hydrogen pickup with no titanium.

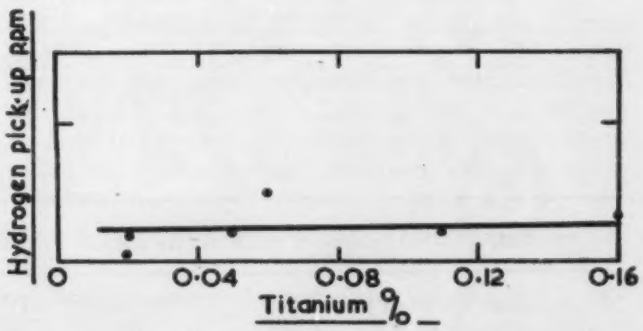

Fig. 13—Effect of titanium on hydrogen pickup. No aluminum.

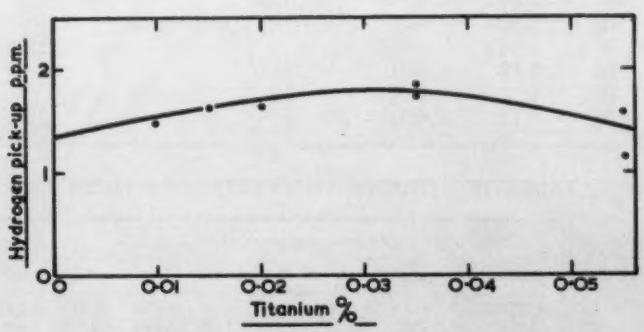

Fig. 14—Effect of titanium on hydrogen pickup. With aluminum.

TABLE 8—CHEMICAL ANALYSES OF MELT 4

	Composition, %						
Tap No.	T.C.	Si	Mn	S	P	Ti	Al
4a	3.52	2.56	0.47	0.017	0.56	0.02	N.D.
4b	–	2.44	0.51	0.015	–	0.16	"
4c	–	2.58	0.49	0.015	–	0.11	"
4d	–	2.52	0.51	0.015	–	0.07	"
4e	–	2.50	0.50	0.014	–	0.05	"
4f	–	2.60	0.48	0.014	–	0.02	"
4g	–	2.54	0.48	0.014	–	0.02	0.02
4h	3.39	2.48	0.48	0.016	0.56	0.04	0.02

N.D. = not detected.

TABLE 9—HYDROGEN PICKUP IN MELT 4

Tap No.	Ti, %	Al, %	Hydrogen, ppm Pickup in Red Sand
4a	0.02	N.D.	0.06
4b	0.16	N.D.	0.31
4c	0.11	N.D.	0.21
4d	0.07	N.D.	0.49
4e	0.05	N.D.	0.22
4f	0.02	N.D.	0.21
4g	0.02	0.02	1.75
4h	0.04	0.02	1.34

N.D. = not detected.

TABLE 10—CHEMICAL ANALYSES OF MELT 5

	Composition, %						
Tap No.	T.C.	Si	Mn	S	P	Ti	Al
5a	3.48	2.65	0.51	0.018	0.54	0.01	N.D.
5b	3.48	2.67	0.51	0.017	–	0.01	0.02
5c	3.51	2.60	0.50	0.017	–	0.015	0.02
5d	3.48	2.71	0.51	0.019	–	0.020	0.02
5e	3.35	2.64	0.50	0.020	–	0.035	0.02
5f	3.40	2.65	0.49	0.017	0.52	0.055	0.02

N.D. = not detected.

TABLE 11—HYDROGEN PICKUP IN MELT 5

Tap No.	Ti, %	Al, %	Hydrogen, ppm Pickup in Red Sand
5a	0.01	N.D.	0.19
5b	0.01	0.02	1.48
5c	0.015	0.02	1.63
5d	0.020	0.02	1.63
5e	0.035	0.02	1.76
5f	0.055	0.02	1.62

N.D. = not detected.

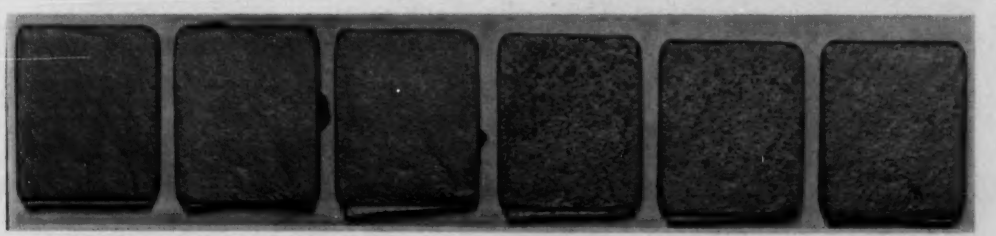

Fig. 15—Pinholing due to aluminum and titanium.

A number of noteworthy points arise from the above series of experiments. Small additions of aluminum greatly increase the hydrogen pickup from the sand mold and can cause pinholing in red-sand castings when titanium is also present. The pickup in black sand is greater than in red sand, but pinholing is very much less likely to occur. The absence of titanium does not reduce the hydrogen pickup but it does reduce the pinholing tendency. There is therefore only a limited correlation between hydrogen pickup and the tendency to pinholing.

Effect of Magnesium

Gittus[10] has suggested that magnesium is the cause of pinholing in nodular iron castings.

A series of increasing nickle/magnesium additions were made in Experiment 6, the analysis of which is given in Table 12. The hydrogen pickup results are shown in Table 13 and plotted in Fig. 16.

TABLE 12–CHEMICAL ANALYSES OF MELT 6

Tap	Composition, %						
No.	T.C.	Si	Mn	S	P	Ni	Mg
6a	3.04	1.99	0.56	0.024	0.045	<0.10	<0.005
6b	–	1.91	0.56	0.019	–	0.19	<0.005
6c	–	1.97	0.62	0.022	–	0.39	0.026
6d	–	1.90	0.60	0.021	–	0.71	0.051
6e	–	1.97	0.61	0.022	–	1.12	0.093

TABLE 13–HYDROGEN PICKUP IN MELT 6

Tap No.	Magnesium Content, %	Hydrogen, ppm	
		Pickup in Green Red Sand	Pickup in Green Black Sand
6a	<0.005	0.31	0.40
6b	<0.005	0.20	0.42
6c	0.026	0.70	0.67
6d	0.051	1.38	1.20
6e	0.093	1.88	2.53

The hydrogen pickup is proportional to the magnesium content, and it is quite high at 0.1 per cent magnesium. Again the figures are a little higher in black sand than in red sand.

No pinholes occurred in any of the plates at any level of magnesium.

EFFECT OF FERRO-SILICON AND ALUMINUM IN NODULAR IRON

Nodular iron is usually inoculated with ferro-silicon and ferro-silicon contains a small percentage of aluminum.

In Experiment 7 additions of ferro-silicon and additions of aluminum equivalent to that in the addition of ferro-silicon (2.7 per cent aluminum) were made at two levels of magnesium. The analyses are given in Table 14. The red sand hydrogen figures are given in Table 15 and shown diagrammatically in Fig. 17. At each magnesium level the ferro-silicon and aluminum have given similar increases in hydrogen pickup.

In the absence of ferro-silicon or aluminum no pinholing occurred at either magnesium level. Severe pinholing was found in red sand castings with both

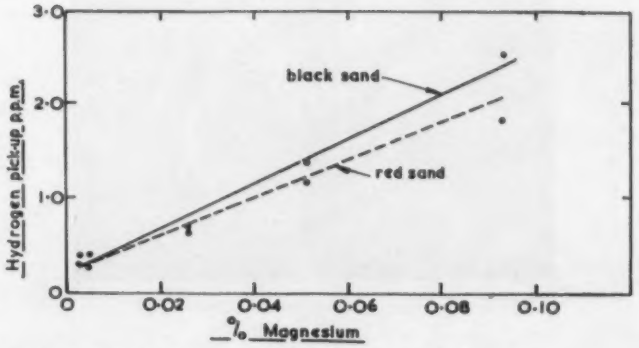

Fig. 16–Effect of magnesium on hydrogen pickup.

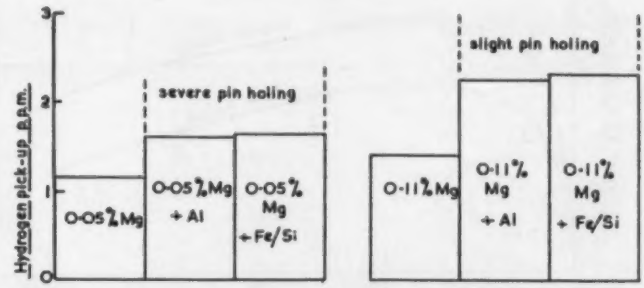

Fig. 17–Effect of aluminum on hydrogen pickup in nodular graphite iron.

TABLE 14 – CHEMICAL ANALYSES OF MELT 7

Tap No.	Composition, %								
	T.C.	Si	Mn	S	P	Ni	Mg	Al	Ti
7a	3.23	1.75	0.51	0.020	0.054	1.03	0.047	<0.01	0.03
7b	3.21	1.80	0.52	0.019	–	0.95	0.039	0.02	–
7c	3.03	2.17	0.50	0.020	–	1.00	0.043	0.015	–
7d	3.17	1.84	0.53	0.017	–	1.86	0.12	<0.01	–
7e	3.17	1.79	0.52	0.013	–	1.87	0.11	0.02	–
7f	3.01	2.17	0.50	0.024	0.049	1.87	0.11	0.015	0.03

TABLE 15 – HYDROGEN PICKUP IN MELT 7

Tap			Hydrogen Pickup in Red Sand, ppm		
No.	Mg, %	Al, %	No Treatment	Aluminum Added	Fe-Si Added
7a	0.047	<0.01	1.13	–	–
7b	0.039	0.02	–	1.62	–
7c	0.043	0.015	–	–	1.64
7d	0.12	<0.01	1.40	–	–
7e	0.11	0.02	–	2.25	–
7f	0.11	0.015	–	–	2.29

TABLE 16 – CHEMICAL ANALYSES OF MELT 8

Tap No.	Composition, per cent								
	T.C.	Si	Mn	S	P	Ni	Mg	Al	Ti
8a	3.20	1.91	0.64	0.022	0.066	1.13	0.052	N.D.	0.035
8b	3.20	1.82	0.63	0.021	–	1.08	0.044	<0.01	–
8c	3.20	1.83	0.64	0.024	–	1.13	0.045	0.01	–
8d	3.19	1.86	0.68	0.019	–	1.07	0.043	0.02	–
8e	3.18	1.89	0.65	0.017	–	1.14	0.043	0.11	–
8f	3.14	1.82	0.63	0.015	0.063	1.08	0.037	0.23	0.035

N.D. = not detected.

ferro-silicon and aluminum additions with 0.05 per cent magnesium, but this was almost completely suppressed by the 0.1 per cent magnesium addition. All the red sand cast plates with 0.05 per cent magnesium additions are shown in Fig. 18.

Previous work[10] had shown that more than 0.2 per

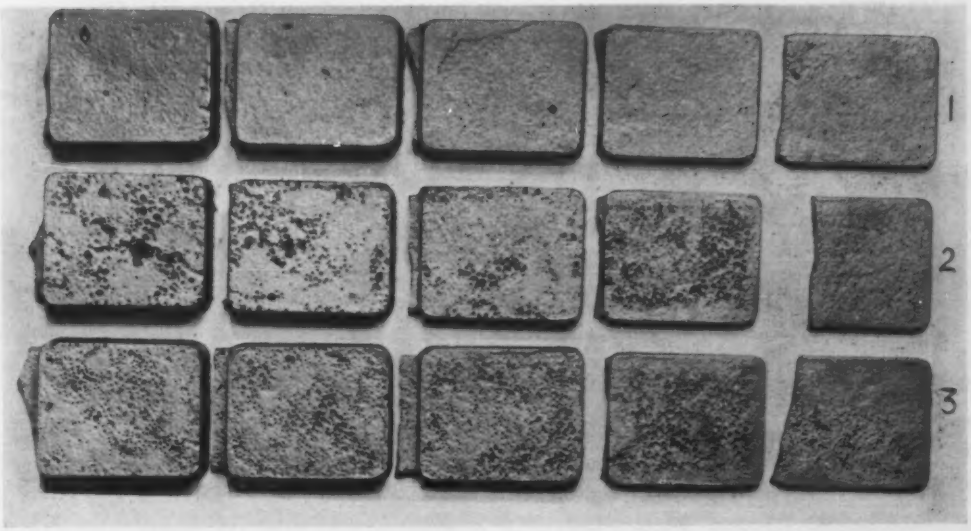

Fig. 18—Pinholes caused by the addition of aluminum or ferro-silicon to nodular graphite iron.

cent aluminum prevented pinholing occurring in nodular iron castings.

In Experiment 8, increasing aluminum additions up to 0.23 per cent aluminum were made in the presence of a normal constant magnesium addition. The chemical analyses are given in Table 16 and the hydrogen figures in red sand in Table 17 and Fig. 19.

The aluminum sharply increases the hydrogen pickup and then begins to reduce it. The ¼-in. plates cast in red and black sand are shown in Fig. 20. The first addition of aluminum which was 1 gram in 40 lb metal (less than 0.005%) has considerably increased the pinholing tendency in red sand, and this tendency has increased to a maximum at number 4 which had 5 grams aluminum added to 40 lb metal (0.028%). Above this addition the pinholing is reduced again.

Very little pinholing occurred in black sand though a number of large flaws were apparent on some of the plates.

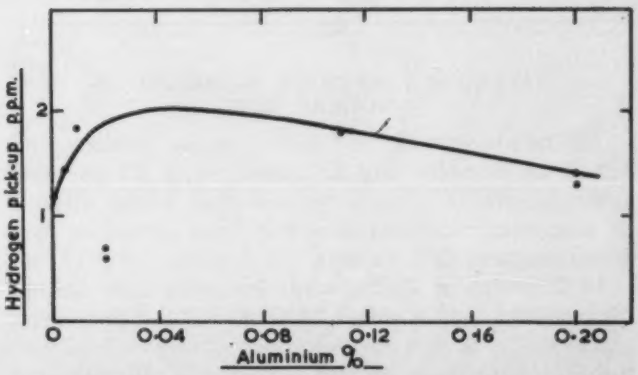

Fig. 19—Effect of aluminum on hydrogen pickup in nodular graphite iron.

TABLE 17 — HYDROGEN PICKUP IN MELT 8

Tap No.	Al, %	Hydrogen, ppm Pickup in Red Sand
8a	N.D.	1.19
8b	<0.01	1.43
8c	0.01	1.84
8d	0.02	0.69
8e	0.11	1.80
8f	0.23	1.34

In view of the suppression of pinholing by the higher magnesium addition in Experiment 7 a series was prepared (Experiment 9) with a constant aluminum addition and increasing additions of nickel/magnesium. The analyses are given in Table 18 and the hydrogen results for red sand in Table 19 and Fig. 21.

In the presence of aluminum, magnesium increases the hydrogen pickup up to about 0.07 per cent magnesium and then begins to reduce it again.

No pinholing occurred in the black-sand castings and pinholing only occurred in the plates with 0.038 and 0.067 per cent magnesium, cast in red sand.

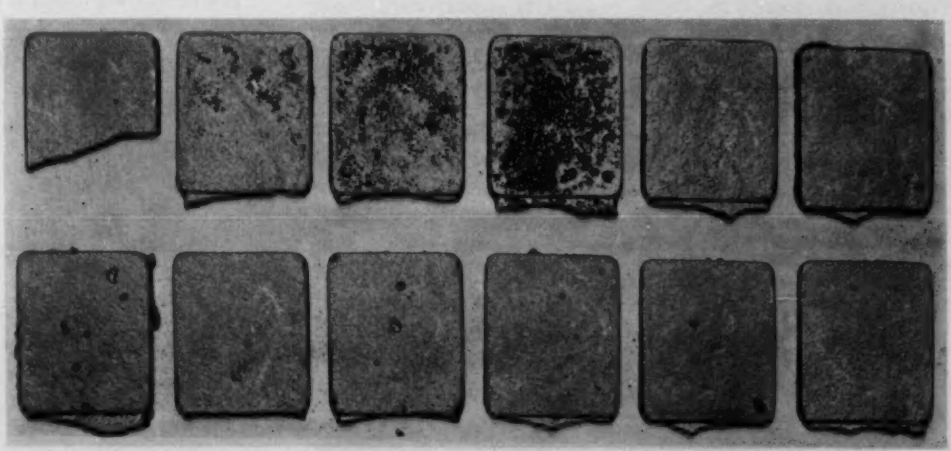

Fig. 20—Effect of aluminum on pinholing in nodular graphite iron.

TABLE 18 – CHEMICAL ANALYSES OF MELT 9

Tap No.	Composition, % T.C.	Si	Mn	S	P	Ni	Mg	Al
9a	3.26	1.73	0.46	0.049	0.058	0.69	<0.01	<0.01
9b	–	1.71	0.45	0.029	–	1.85	<0.01	<0.01
9c	–	1.75	0.47	0.021	–	1.44	0.021	<0.01
9d	–	1.74	0.47	0.019	–	1.78	0.038	<0.01
9e	–	1.76	0.50	0.013	–	1.76	0.067	<0.01
9f	3.16	1.80	0.51	0.014	0.048	1.78	0.12	<0.01

TABLE 19 – HYDROGEN PICKUP IN MELT 9

Tap No.	Mg, %	Hydrogen, ppm Pickup in Red Sand
9a	<0.01	1.12
9b	<0.01	0.92
9c	0.021	1.05
9d	0.038	1.93
9e	0.067	2.36
9f	0.12	1.96

TITANIUM EFFECT ON PINHOLING IN NODULAR IRON

All the above melts in the magnesium sections were based on hematite pig iron containing 0.1 per cent titanium, and it is fairly obvious that, in the absence of aluminum, titanium does not cause pinholing even when magnesium is present.

In Experiment 10, Swedish iron was used instead of hematite, and a series of titanium additions were made in the presence of constant additions of aluminum and magnesium. The chemical analyses are shown in Table 20, and the hydrogen results in red sand in Table 21 and Fig. 22.

Although there is rather a wide scatter the titanium has not had any consistant effect on the hydrogen pickup. The ¼-in. plates in red and black sand are shown in Fig. 23. Although pinholing can occur in red sand castings with magnesium and aluminum and no titanium, it is much more likely to occur when titanium is also present.

The major point arising from the foregoing series of experiments is that although magnesium by itself does not give pinholing, very minute traces of aluminum will give pinholing in the presence of magnesium, particularly if titanium is also present.

TABLE 20 – CHEMICAL ANALYSES OF MELT 10

Tap No.	Composition, % T.C.	Si	Mn	S	P	Ni	Mg	Al	Ti
10a	3.33	2.45	0.49	0.014	0.020	0.76	0.063	N.D.	<0.01
10b	–	2.50	0.49	–	–	0.76	0.063	0.015	<0.01
10c	3.43	2.45	0.50	0.014	–	0.73	0.059	0.015	0.02
10d	–	2.52	0.50	–	–	0.70	0.064	0.015	0.04
10e	–	2.38	0.48	–	–	0.71	0.057	0.015	0.06
10f	3.34	2.48	0.49	0.005	0.020	0.71	0.059	0.015	0.17

TABLE 21 – HYDROGEN PICKUP IN MELT 10

Tap No.	Al, %	Ti, %	Hydrogen, ppm Pickup in Red Sand
10a	N.D.	<0.01	1.43
10b	0.015	<0.01	2.02
10c	0.015	0.02	2.09
10d	0.015	0.04	2.55
10e	0.015	0.06	1.73
10f	0.015	0.17	2.33

N.D. = Not detected.

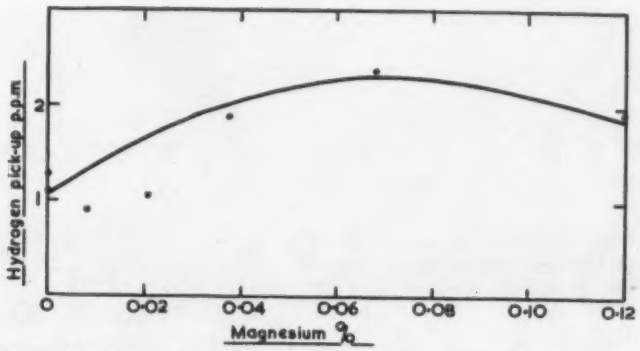

Fig. 21–Effect of magnesium in the presence of aluminum on hydrogen pickup.

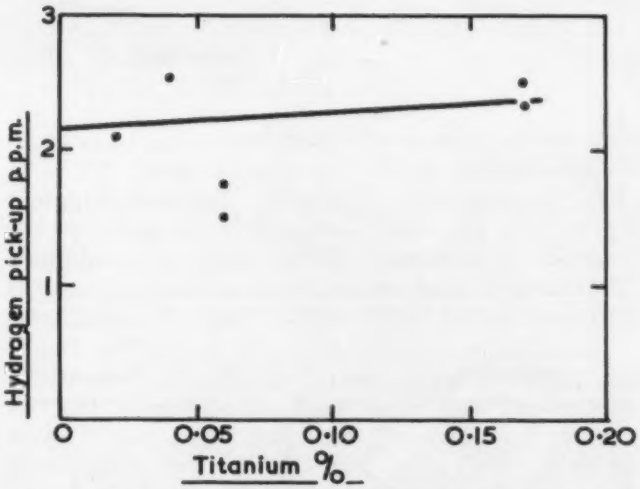

Fig. 22–Effect of titanium on hydrogen pickup in nodular graphite iron.

HYDROGEN CONTENT EFFECT

In all the previous experiments, whenever pinholing has occurred the hydrogen pickup has been high, although the converse is not true. It would appear, therefore, that hydrogen plays an important part in the formation of pinholes, but it is not the only factor. It appears reasonable to expect that increasing the initial hydrogen content of the metal before casting might increase the tendency of an iron to pinhole. No effect was found from increasing the initial hydrogen content from 1 to 3 ppm, but this may be an insignificant increase compared with the increase which occurs locally at the casting skin when pinholes form.

OTHER ELEMENTS EFFECT

Bismuth was reported to suppress pinholing in nodular iron. The pinholing in a gray iron due to the addition of 0.03 per cent aluminum was suppressed by the addition of 0.02 per cent bismuth, but no change in hydrogen pickup was found.

Other experiments have been carried out with sulfur, boron and vanadium, both with and without aluminum. No effect on pinholing or hydrogen pickup was found.

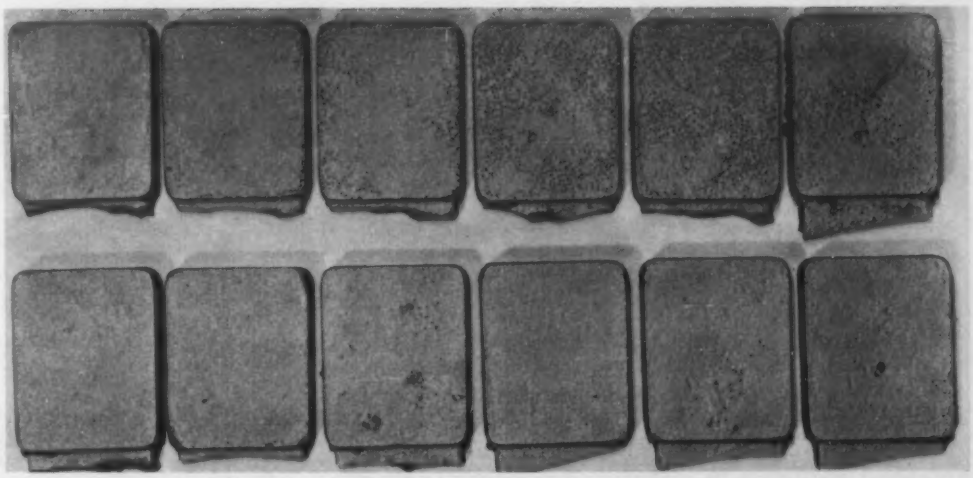

Fig. 23—Effect of titanium on pinholing in nodular graphite iron.

TABLE 22 – HYDROGEN PICKUP IN MELT 11

Tap No.	Pitch in Sand, %	Hydrogen, ppm Pickup in Sand Mold
11a	Nil	1.58
11b	0.22	1.96
11c	0.35	1.56
11d	0.65	1.64
11e	1.87	1.44
11f	3.18	1.96

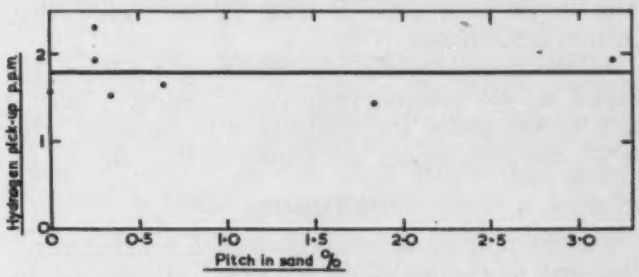

Fig. 24—Effect of pitch on hydrogen pickup.

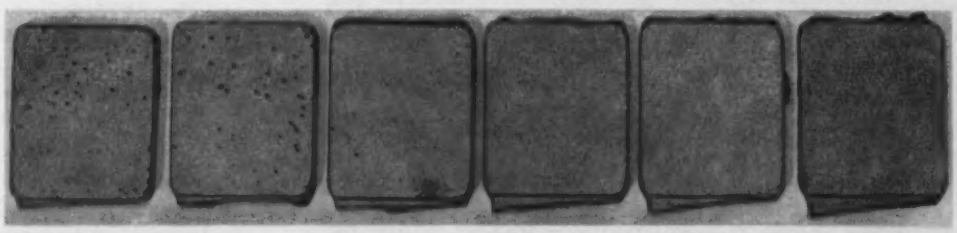

Fig. 25—Pinholing suppressed by pitch in the sand.

TABLE 23 – HYDROGEN PICKUP IN MELT 12

Tap No.	Woodflour in Sand, %	Hydrogen, ppm Pickup in Sand Mold
12a	Nil	1.9
12b	0.25	2.0
12c	0.5	1.7
12d	1.0	1.6
12e	1.5	1.5
12f	2.0	1.5

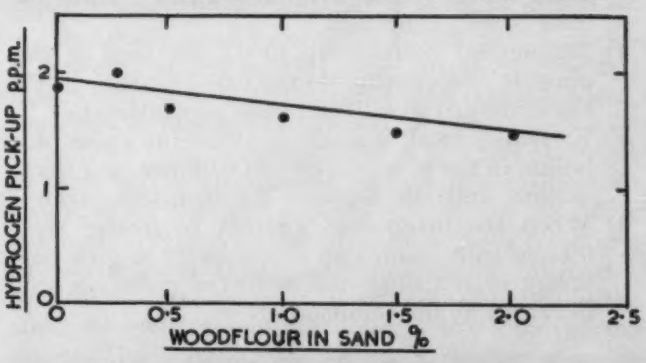

Fig. 26—Effect of woodflour on hydrogen pickup.

ADDITIONS TO SAND EFFECT

1. *Coal dust.* In all the previous experiments natural red sand and red sand +6 per cent coal dust were used. In every case the sand with the coal dust almost completely suppressed the pinholing which occurred in the molds with no coal dust. Contrary to what might be expected from this, the hydrogen pickup tended to be higher in the presence of coal dust.

2. *Pitch.* Gittus[10] has shown that 2 per cent pitch in the sand suppressed pinholing in nodular iron.

In Experiment 11 a series of red sands containing increasing pitch contents up to 3 per cent was used. Aluminum was added to the iron before casting in order to produce a strong pinholing tendency. The hydrogen figures are shown in Table 22 and Fig. 24. No consistant trend was evident with increasing pitch contents. The ¼-in. plates from each tap are shown in Fig. 25 and it is obvious that more than 0.2 per cent pitch has suppressed the pinholing.

3. *Woodflour.* Experiment 12 was a repeat of the previous pitch experiment with woodflour substituted for the pitch. The hydrogen figures are given in Table 23 and Fig. 26.

A small reduction in hydrogen pickup occurred as the woodflour content of the sand increased.

The ¼-in. plates are shown in Fig. 27. There is a gradual suppression of pinholing as the woodflour content increases but it is not complete at 2 per cent woodflour.

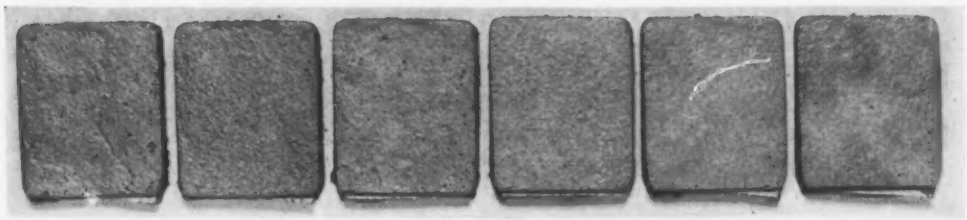

Fig. 27—Effect of woodflour on pinholing.

POURING TEMPERATURE EFFECT

Preliminary experiments, not reported here, showed that decreasing the pouring temperature decreased the hydrogen pickup. An aluminum-containing iron was poured at a series of temperatures from 1450 to 1270 C into red-sand molds in Experiment 13. The hydrogen pickup figures are given in Table 24 and Fig. 28. A reduction in pickup occurs as the temperature drops from 1450 to 1400 C, but below that there is little change.

In the thinner plates the pinholing tendency reduced as the pouring temperature reduced, but in the thicker plates the converse was apparent. The ¼-in. and ⅝-in. plates are shown in Fig. 29.

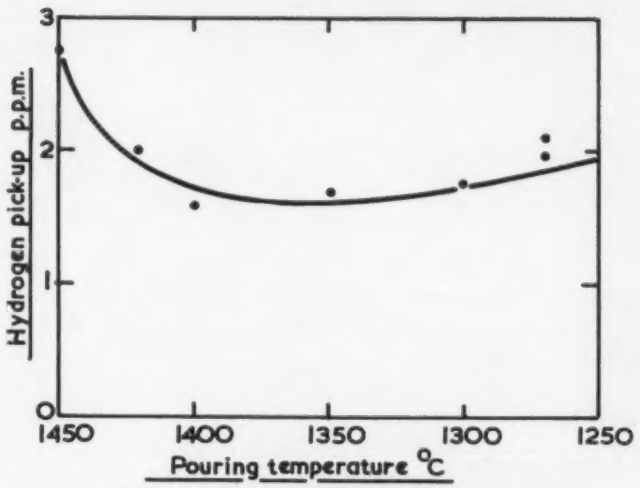

Fig. 28—Effect of pouring temperature on hydrogen pickup.

CONCLUSIONS

For the purpose of comparison each conclusion refers first to the pinholing tendency, and second to hydrogen pickup from the mold.

1) Aluminum contents between 0.01 and 0.10 per cent cause pinholing in gray iron and very markedly increases the hydrogen pickup.
2) Aluminum contents over 0.2 per cent reduce the pinholing tendency in gray iron and decrease the hydrogen pickup.
3) If titanium is absent aluminum is less likely to cause pinholing in gray iron, but titanium has little effect on the hydrogen pickup either by itself or with aluminum.
4) Magnesium contents up to 0.1 per cent in the absence of aluminum do not cause pinholing, but the hydrogen pickup increases proportionately.
5) Extremely small amounts of aluminum cause pinholing in the presence of 0.04-0.06 per cent magnesium, and also increase the hydrogen pickup.
6) When the magnesium content is greater than 0.1 per cent, aluminum is less likely to give pinholing even though the hydrogen pickup is still increased by the aluminum.
7) The aluminum content of commercial ferro-silicon can cause pinholing when used as an inoculant in nodular iron, and the hydrogen pickup is increased as with aluminum alone.
8) Aluminum is more likely to cause pinholing in nodular iron when about 0.04 per cent titanium is present, although it can occur with very much lower titanium contents. The hydrogen pickup is unaffected by the titanium.
9) Increasing the magnesium content above 0.1 per

TABLE 24 – HYDROGEN PICKUP IN MELT 13

Tap No.	Pouring temperature, C	Hydrogen, ppm Pickup in Red Sand
13a	1450	2.76
13b	1420	2.02
13c	1400	1.61
13d	1350	1.71
13e	1300	1.75
13f	1270	1.99

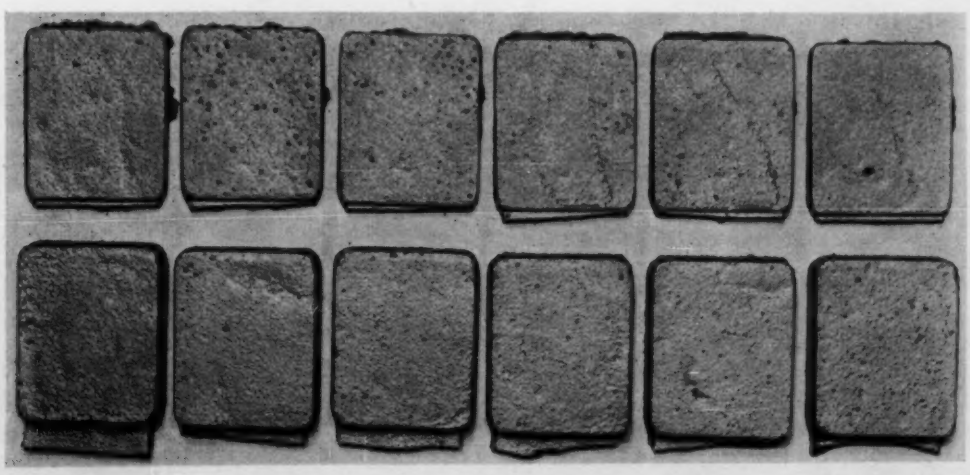

Fig. 29—Effect of pouring temperatures on pinholing, top ¼-in., bottom ⅝-in.

cent in the presence of aluminum reduces the pinholing tendency and is inclined to reduce the hydrogen pickup.

10) Aluminum in excess of 0.2 per cent reduces pinholing in nodular iron and reduces the hydrogen pickup.

11) Manganese contents over about 4 per cent give pinholing and an extremely high hydrogen pickup.

12) 0.02 per cent bismuth additions limit pinholing in gray iron but do not affect the hydrogen pickup.

13) Coal-dust additions to the sand considerably reduce the pinholing tendency, but slightly increase the hydrogen pickup.

14) The addition of pitch to the sand strongly reduces the pinholing tendency without affecting the hydrogen pickup.

15) The use of woodflour in the sand reduces pinholing a little and slightly reduces the hydrogen pickup.

16) Lowering the pouring temperature tends to move the pinholing from thin to thick sections. The hydrogen pickup is reduced between 1450 and 1400 C, but reducing the temperature below this has little effect on the hydrogen pickup.

DISCUSSION

In view of the fact that the hydrogen content of liquid iron can be raised by plunging damp sand into the iron bath, it is not surprising that a similar rise occurs in the sand mold. This hydrogen must come from decomposed water vapor. It would be expected that the presence of easily oxidizable elements in the iron would increase this decomposition. Increasing the pouring temperature should increase the rate of reduction, and probably the rate of solution of the hydrogen released.

It is surprising that, whereas aluminum, magnesium and manganese all encourage hydrogen absorption, this pickup is proportional to the magnesium and manganese contents but not to the aluminum content. (There is a little evidence that above 0.1 per cent magnesium this proportionality ceases and the pickup begins to fall again.) This may be due to a tenacious aluminum oxide layer which limits either the reaction with water vapor or the solution of hydrogen.

Hydrogen Solubility

When water vapor is decomposed by contact with molten iron, oxides, such as FeO, MnO, Al_2O_3, etc., are likely to be formed, together with hydrogen gas. Thus, the more extensive the metal/moisture reaction the greater is the absorption of hydrogen likely to be. The solubility probably decreases with decreasing temperature and shows a very marked decrease on solidification. If the increased pickup is very great the gas will be evolved during solidification and give blowholes. The shape, distribution and nature of the blowholes will depend on the hydrogen content, the distribution of that hydrogen throughout the metal, and on the mechanism of solidification of the metal.

The mechanism of formation of pinholes is not completely clear, but their spheroidal character suggests that most of the iron is liquid when they are formed. Their position just below the casting skin suggests that they form just after the very first metal solidifies, and they probably contain gas evolved from this metal on solidification. If the pinholes were solely due to hydrogen pickup it would be expected that they would always form when the hydrogen pickup was high. This, however, is not the case, the effect of tianium in the metal being a good example. Obviously, there is some controlling factor.

Factors Affecting Hydrogen

This attempt to correlate pinholing with hydrogen pickup assumes that the overflow technique is fully representative. This may not be the case. In the overflow the metal traverses an area of sand in a turbulent manner, continually exposing new surfaces in contact with sand, whereas in the plate castings, and in most commercial castings, there is only a short flow over sand before quiescent solidification takes place. It is possible that some factors may affect the total hydrogen pickup while others may only vary the rate of pickup. The overflow method may not distinguish between these.

The contact angle between the metal and the sand may be one of these factors. The red sand appeared to be "wet" by the metal, whereas the black sand was not. Pinholing was rarely found in black sand even though the pickup was higher.

From a practical viewpoint it appears that the foundryman can avoid the pinholing problem by using ample coal dust and/or pitch in his sand, and by avoiding combinations of aluminum and titanium in his metal. However, among the infinite variety of castings made in the industry, it is likely that there are some very much more prone to pinholing than the test plates used here. Also, some metal compositions may be more prone to pinholing than others. Indeed, since this work was carried out a number of industrial cases have been investigated in which the coal dust or pitch in the sand would be considered ample on the basis of the above findings, and yet pinholing has been very serious. In all of these cases the prime cause has been traced to aluminum in the metal, originating from a variety of sources, and usually the stringent avoidance of this element has removed the defect. The more common sources of aluminum are light alloy pistons, covers, etc., on engine scrap, steel scrap heavily "killed" with aluminum, and aluminum-bearing inoculants such as ferro-silicon and S.M.Z. This last point is particularly important in nodular iron production, but some care has to be taken in using low aluminum inoculants as poor inoculation can result.[12]

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WRITTEN DISCUSSION IS SOLICITED

OBSERVATIONS ON PINHOLE DEFECTS IN WHITE IRON CASTINGS

By
R. W. Heine*

Producers of malleable iron are occasionally plagued with pinhole defects on white iron castings. Several fundamental causes of pinholing exist, and a much larger number of associated variables influence the severity of the defect. Thus, when this problem arises, it is usually difficult to ascertain the exact cause of the pinholing and to prescribe remedial measures. This article summarizes some basic causes of pinholing, related foundry variables, and the likely remedies.

TYPES OF PINHOLES

Identifiable types of pinholes observed on white iron castings include the following:

Type I–Reaction pinholes
Type II–Aspiration pinholes or bubbles
Type III–Evolution pinholes
Type IV–Miscellaneous (isolated pinholes)

Type I–Reaction Pinholes

Reaction pinholes, such as shown in Fig. 1, develop at the casting surface by reaction of carbon in the iron with oxygen usually in the form of oxides. They occur in clusters or groupings at the casting skin or just below, are elongated in shape, are commonly, although not always, darkened by oxidation, and rarely are found in the interior of a section. Such reaction pinholes are shown at the surface of a fractured white iron casting in Fig. 2. Cause of the reaction is the inherent chemical tendency of white iron to form an iron oxide-rich slag. During cooling of the iron in the ladle and in the gating during pouring, the slag is formed by the following reactions:

1) $\underline{Si} + \underline{Fe} + \underline{O}\dagger \rightarrow xFeo \cdot y\,SiO_2$, or

2) $Feo + SiO_2 \rightarrow xFeo \cdot y\,SiO_2$

†Oxygen from any source such as water vapor, iron oxide in the molding sand, atmospheric O_2, FeO in the iron, etc. $\underline{Si}$ refers to silicon in the molten iron.

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The conditions under which these reactions occur have been described by the author in Reference 1. Below about 2600 to 2530 F the reactions are spontaneous, inevitable, and result in the formation of the iron oxide rich-iron silicate slag. This slag may accumulate in ladles and gating systems and be carried into the casting. Composition of the slag depends on temperature and the prevailing oxidizing condition. Samples of the slag which have been analyzed reveal from 42 to 68 per cent FeO, balance SiO_2 and a few per cent of MnO. When this slag is carried into the casting, pinholing can occur by the following chemical reaction:

3) FeO (from the slag) + $\underline{C}$ (in the iron) → Fe + CO (the pinhole)

The evolution of the CO nucleates the pinhole and permits it to grow. Since the slag reaction causes this type of pinholing, pinholes and slag are usually intermixed. If the pinholed surface is lightly ground, a cloud of slag particles is formed coincident with the pinholes as in Fig. 3. Metallographic examination of the surface of the casting shows the presence of the

Fig. 1–Reaction pinholes at surface of annealed casting.

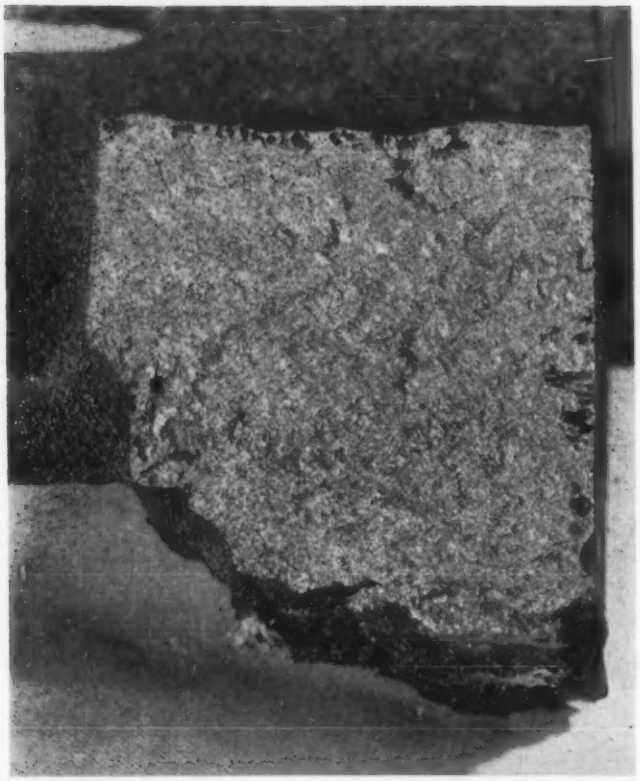

Fig. 2—Reaction pinholes at surface of fractured white iron casting.

iron oxide-rich silicate slag and pinholes nucleated at slag particles as shown in Figs. 4 and 5. Figure 5, particularly, shows how a pinhole can be generated by the slag-metal reaction. The pinhole starts at the surface where the slag is accumulated and extends down into the casting as the reaction proceeds.

Suspicion of slag reaction as a source of pinholing may be tested by adding 0.02 to 0.15 per cent aluminum to the iron. Since aluminum reacts with oxygen more strongly than does carbon, aluminum in the iron prevents carbon monoxide from forming according to Reaction 3, and then the pinhole cannot develop. Although the pinholes will not be present, some slag will appear at the location formerly showing both pinholes and slag. While the aluminum addition may cause mottling in some irons, it still provides a means of testing on a trial basis for identification of reaction pinholing. The other types of pinholings discussed later are not prevented by aluminum additions to the iron.

Reaction pinholing may be more or less severe, or absent depending on a number of associated foundry variables. Any variable which promotes the oxidation reaction will increase the incidence of pinholes. For instance, excessive free moisture in the sand, undermulled sand permitting a poor distribution of the water present, balling of sand, accumulation of iron oxide and iron silicate in the re-used sand, slag accumulations in feeders, slow pouring, high pouring temperature, hot-spots, gating that generates slag, and solidification caused by an insulating molding sand all increase the likelihood of reaction pinholing. However, it is generally only when the slag has a chance to accumulate and wash into the casting under oxidizing conditions that pinholes result. A cloud of slag washed into the casting will deposit on either the mold or the core surface, and then the pinhole reaction begins. The iron oxide content of the slag is enriched by reaction with oxygen, water vapor, and iron oxide in the sand to the point where carbon in the iron is oxidized to CO and the pinhole is nucleated; water vapor can then aggravate the pinhole by enlarging it or blowing it up. Thus, the slag cloud and pinholes occur together. This chain of events occurs most readily with a certain combination of gating and casting that is recognizable. There is usually a large heavy riser feeding several castings. Usually, the riser cannot be kept full during pouring because of

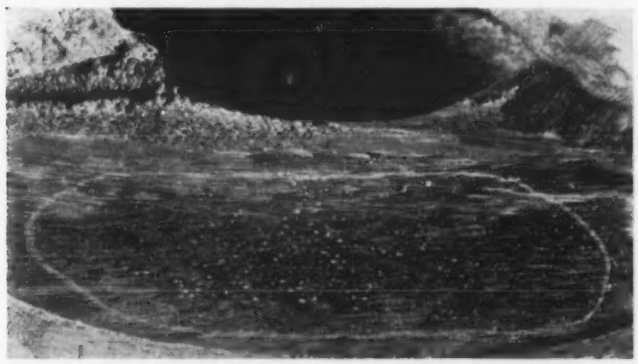

Fig. 3—Lightly ground white iron casting surface showing a cloud of intermixed slag particles and pinholes.

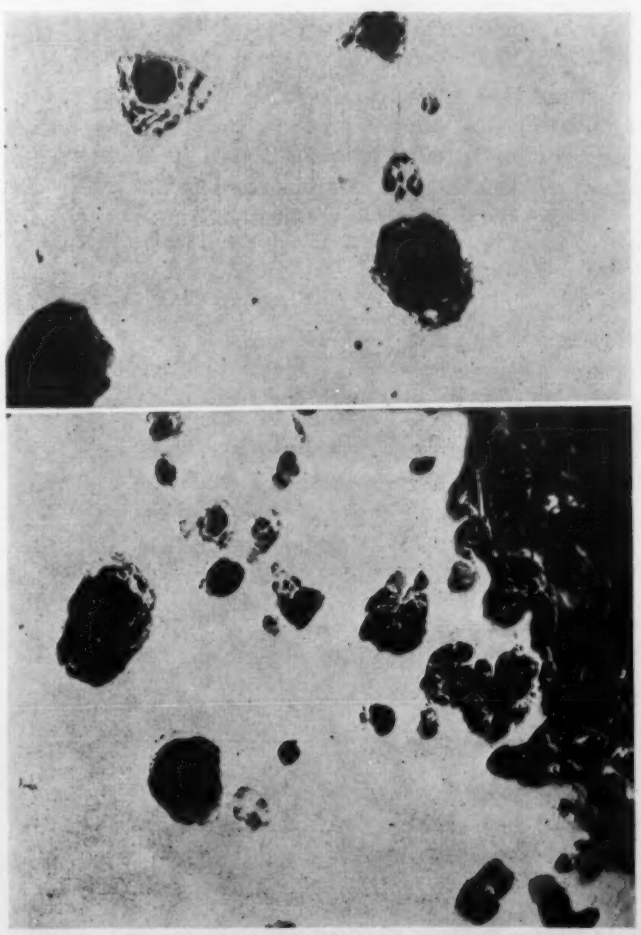

Fig. 4—Intermixed slag and pinholes at metallographically prepared surface of white iron casting. Unetched. ×50.

large connecting pads to several castings, as shown in Fig. 6. So slag accumulating in the riser enters the casting and is deposited on the mold or core surface. Pinholing proceeds. Figure 7 shows a casting with pinholes resulting from slag accumulations washing into the casting from a riser.

While the foregoing describes factors that contribute to the development of reaction pinholes, it is the slag-metal reaction which is the basic cause. For instance, water in the sand will not be the major contributor if the gating develops slag and permits it to enter the casting. Even when the same mold is baked dry, pinholing will still occur in the absence of water if the gating still permits slag to form and enter the casting. However, if very little slag is formed then water in the sand may be oxidizing enough to cause more slag to form and enter the casting with the result that pinholes develop. Casting size and shape also are factors. Since small, thin castings freeze so

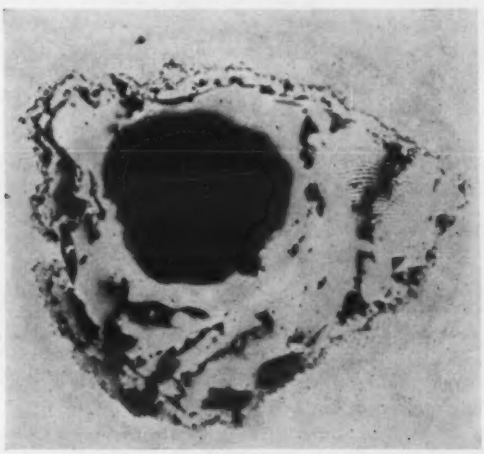

Fig. 5—Pinhole extending down into casting after being generated by reaction of iron oxide-rich slag and carbon in iron. The pinhole appears black and is encircled by slag. ×500.

rapidly, freezing time is so short that the slag reaction does not have time to begin, even though slag may have washed onto the casting.

In rare instances, reaction pinholing can also occur without the presence of slag on the casting surface. A build-up of oxides in system sand, dirt, slag, and scale, in the molding sand can be a direct cause, especially where combined with a high moisture content, undermulled sand. However, in this case, the slag cloud is absent and pinholes with no or only slight oxidation products are present at the surface. With an extreme of moisture present, and especially with a combination of low permeability and poor distribution of moisture from undermulling, pinholes can develop directly at the surface by reaction of water vapor and carbon in the iron. Again, the slag cloud will be absent. However, these variations of reaction pinholing are quite infrequently encountered compared with the slag-induced type.

In view of the mechanism of reaction pinholing, certain foundry variables are found of major importance in eliminating the defect.

1) Gating and pouring. The gating must be designed to trap slag in feeders or runners outside the casting.

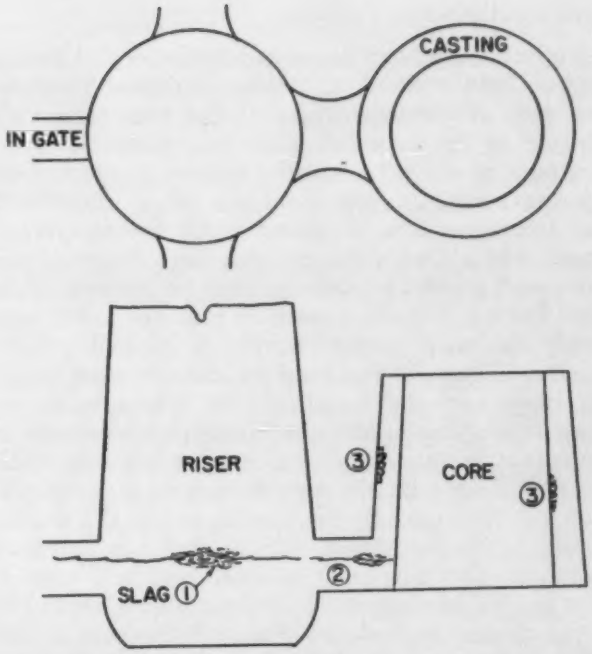

Fig. 6—Gating favoring slag formation and transfer into the casting where reaction pinholes then develop. Numbers indicate sequence of events.

Fast pouring to keep runners and feeders full may be helpful. By contrast, slow pouring may also be helpful if it serves to keep slag out of the casting by lessening turbulence.

2) Scale and dirt must not be allowed to accumulate in the sand. Dilution of used sand with new sand according to a planned replacement program can keep the level of cleanliness high.

3) Moisture level of bentonite-bonded molding sand should be controlled at preferably less than 30 per cent free moisture according to the calculation method described in Reference 2.

4) The molding sand should be thoroughly mulled to distribute the water present. Hot molding sands require longer mulling times in this regard. The items listed above seem to be major variables that contribute to reaction pinholing though they are not the basic cause. Lesser contributors were named in earlier paragraphs.

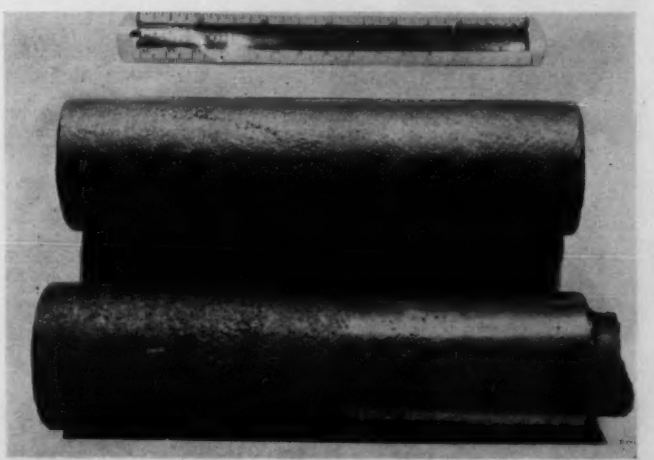

Fig. 7—Reaction pinholing caused by slag accumulations washing into the cope surface of a casting.

Type II—Aspiration Pinholes

Aspiration pinholes are round in shape, and usually appear light colored or mildly oxidized. They are ordinarily randomly distributed, but bear some relationship to the ingate. Usually they occur singly or in groups of a few toward the interior of the casting. However, aspiration pinholes are often mixed with slag because of the turbulent metal flow conditions under which they form, so that both reaction pinholes and aspiration pinholes may be present in the same casting. Usually aspiration pinholes result from poorly designed gating, having a high flow rate. Small area ingates, causing a jet effect in risers, aspirate gases into the metal stream. These gases are carried into the casting as bubbles and remain in the frozen casting. In severe cases, metal shot is developed along with the aspiration process. Often the shot can be found in the casting or on the casting surface as shown in Fig. 8. Sometimes, as in Fig. 8 lower, the shot surface is oxidized and will react to form gas bubbles appearing to be pinholes, especially if the casting is broken open and the shot is lost but its cavity remains behind. Improved gating will prevent this type of pinholing.

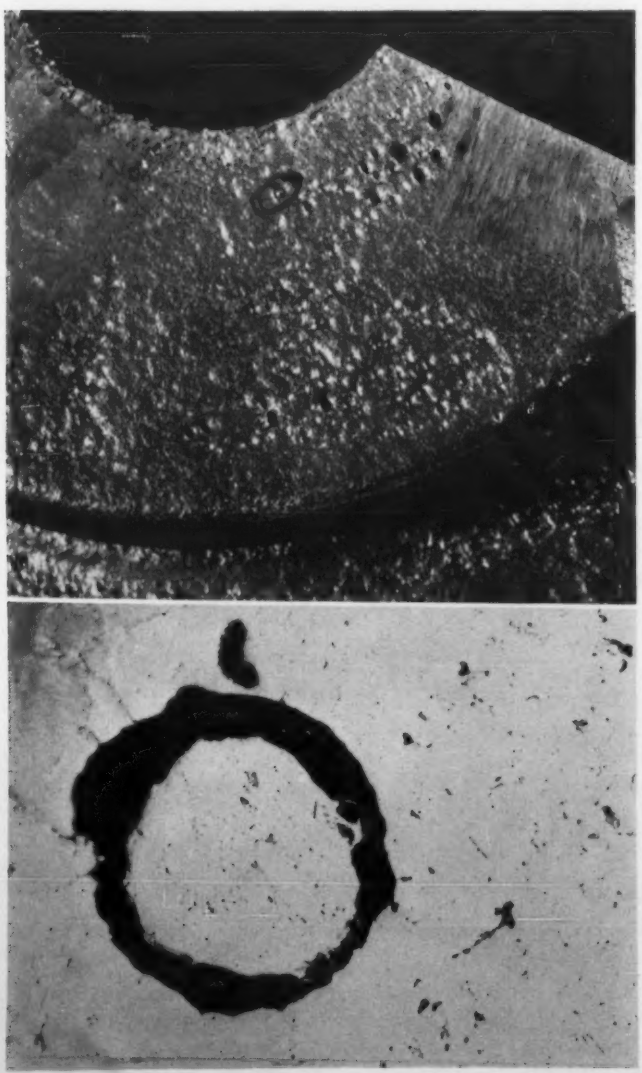

Fig. 8—Upper—Shot associated with pinholes at the surface of an annealed casting. Lower—Shot encased with slag and a gas cavity at surface of a white iron casting.

Type III—Evolution Pinholes

Evolution pinholes are caused by gassy metal. They are usually rounded in shape, have unoxidized, light colored or shiny surfaces, and occur in groupings or clusters in the interior as well as at the surface and subsurface portion of a casting section. Figure 9 illustrates them. If molten iron is badly gassed with hydrogen, the excess will come out very rapidly during cooling and cause widespread formation of bubbles in the interior of the casting as well as the surface. If these bubbles are trapped at a certain time they will have a shiny luster and appear as in Fig. 9, lower.

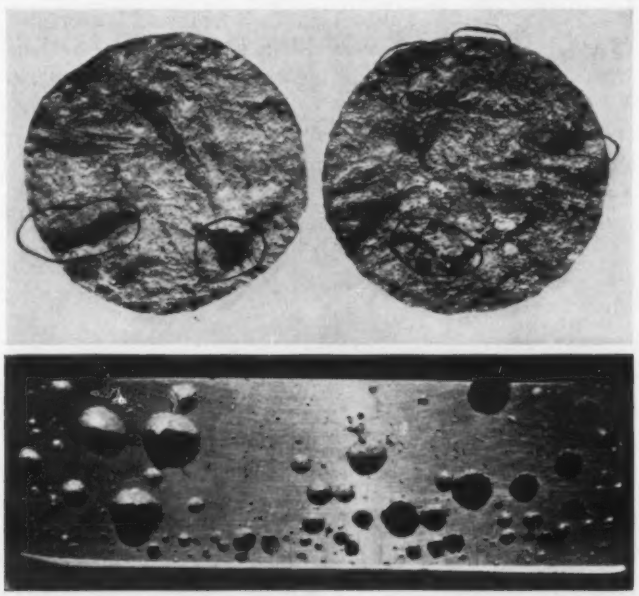

Fig. 9—Upper—Severe gas evolution pinholing caused by hydrogen in metal melted under hydrogen atmosphere. Lower—Gas evolution pinholing caused by nitrogen.

Excessive nitrogen in the iron exhibits a different pinholing behavior from hydrogen. In this case, the pinholes are much less prevalent, tend to be more elongated in shape, and have a light to dark blue luster which makes them difficult to photograph. Figure 9 upper shows such pinholes. Sometimes evolution pinholes are associated with reaction pinholes when the pinholing action is started by the latter. Usually, however, the gas content of the iron is low enough so the pinholing condition would probably be absent if the reaction mechanism did not cause nucleation of the pinholes.

Evolution pinholing due to gassy metal will usually not be eliminated by an aluminum addition to the iron. This, together with observation of whether slag is associated with the pinholes, serves as an additional means of distinguishing between these two types.

An iron high in hydrogen may also show much surface pinholing, as in Fig. 10, as well as internal gas cavities. The surface evolution pinholing will be particularly widespread if the gassed metal is poured against a high moisture content molding sand.

The conditions leading to evolution pinholing are related to melting practices which have been very extensively reported. The presence of sufficient hydrogen or nitrogen in the iron to cause evolution pinholes results from other unusual malpractices in melting which are not within the scope of this paper.

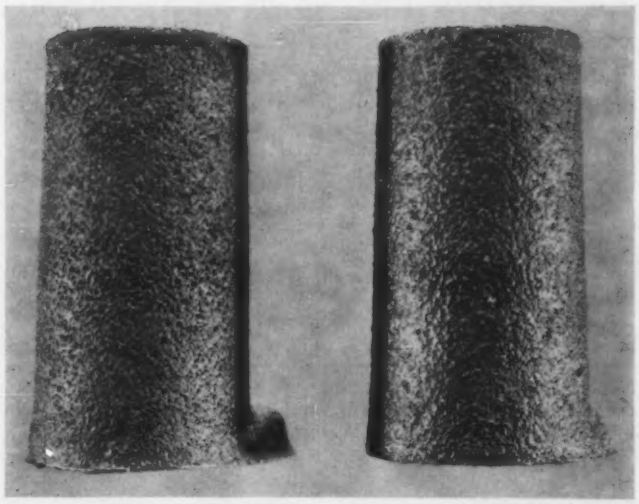

Fig. 10—Widespread pinholing at surface of casting caused by hydrogen in the metal due to melting under an atmosphere high in water vapor.

Such malpractices will normally show up in the melting department records or be apparent to the melting foreman.

Type IV—Miscellaneous Pinholes (isolated)

Occasionally, isolated pinholes may be observed at casting edges, surfaces, or within a section. This type can be caused by loose sand grains. Such pinholes occur most easily when a mold is soft rammed with sand of poor flowability. Rough, grainy finish on the castings is a warning sign that this pinhole type will appear. Another source of this pinhole type lies within the mold cavity when metal falls some distance, cascades over cores, or mold surfaces and then entraps gas bubbles. Gating which is borderline in producing jet effects will also cause isolated pinholes or bubbles. If the casting freezes before the bubbles rise out of the metal, they are entrapped and become isolated pinholes.

SUMMARY

Slag formation during cooling of the molten metal is a major cause of pinhole defects in white iron castings. Reaction pinholes from this source are readily identifiable by their characteristic mode of occurrence. Furthermore, they are the type which are most readily promoted by the variable conditions of gating, pouring, sand and molding practices which prevail in the foundry. The other three types of pinholes, aspiration, evolution, and isolated, are less likely to occur, but they can also be identified by their characteristic mode of occurrence.

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WRITTEN DISCUSSION IS SOLICITED

THE THEORETICAL CONCEPTS OF THE PACKING OF SMALL PARTICLES

By
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Dr. C. E. McQuiston**

Foundry sand grains and granular molding materials are basically small particles. The making of molds and cores involves compaction. Therefore, the laws governing compaction of sand grains are of interest to the foundryman and have many practical applications. These laws governing the compaction of small particles have been thoroughly investigated and at least two excellent summaries are in print.

Starting with the simplest case, compaction of spherical particles of uniform size, the following points have been established mathematically and proven by experiment:

Spherical particles of uniform size may compact into three definite configurations of increasing density, as illustrated by Fig. 1. The least dense cubic packing has the particles in contact at their centerlines, as in Fig. 1a. This configuration compacts to a density of 52.3 per cent solids, 47.7 per cent voids. Each particle has six points of contact with its neighboring particles. The highest density attainable with uniform spherical particles is the rhombohedral packing of Fig. 1b when all the particles are nested into every void. Each grain has 12 points of contact with its neighbors. The mass has a density of 74.1 per cent solid, 25.9 per cent voids. An intermediate type of packing, the orthorhombic, has half the spheres in contact on their centerlines, half nested, as shown in Fig. 1c, with a density of 60.45 per cent solids, 39.55 per cent voids. The particles have eight points of contact.

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It has been established by experiment that when uniform spheres are shaken the mass quickly attains a density of 60.5 per cent, almost exactly that required for orthorhombic packing. It is very difficult, or impossible, to attain higher densities with uniform spherical particles with any degree or type of compaction. The particles crush first.

It will be shown by other papers of this symposium that dry, unbonded sands, even though they are not composed of perfectly spherical uniformly sized particles, follow closely the densities predicted by these theoretical considerations. Therefore, a more detailed study of these theories is in order and has important practical applications.

It has been shown that the densities and percentage voids of a given packing configuration do not change with particle size provided that the particles are uniform in size and spherical. Compacts of very fine particles, say under 200 mesh are slightly less dense than predicted. Angularity of the particles also decreases density, provided that these angular particles are of fairly uniform size. *Void size decreases with decreasing particle size, not the density and total per cent of voids.*

As very high forces are required for the compaction of uniform particles beyond 60.5 per cent density and this density is easily attainable with dry, unbonded grains, this value is fundamental in compaction studies. For example, a sand core compacted to this density or its equivalent, taking into consideration grain shape and distribution, cannot collapse further, even though unbonded. Oil-sand cores are relatively

easily compacted to these densities. It seems possible that the exact density of such cores in relation to the 60.5 per cent density value or its equivalent is a major variable in the collapsibility of the core. Molds, or cores compacted to below this value (or its equivalent taking into consideration grain shape and distribution), will react differently to expansive forces than the same molds or cores compacted to, or above this value.

by a factor of 5 to 10. The three- and four-component systems of Fig. 2 are less dense than a two-component system with a double-peaked distribution throughout the range of particle sizes and distributions given in Fig. 2. This may seem contrary to accepted thought. One reason is that reports of increased density with three or more components of different size in the mass are based on aggregates with variations in particle size 100 times as great as is practical with foundry

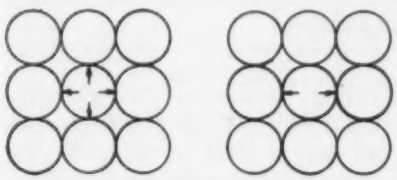

Fig. 1a—Cubic packing—6-point contact—52.3% solid, 47.7% voids

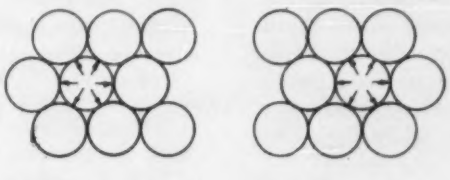

Fig. 1b—Rhombohedral packing—12-point contact—74.1% solid, 25.9% voids

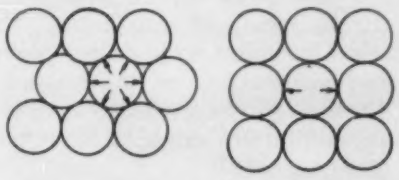

Fig. 1c—Orthorhombic packing, 8-point contact—60.45% solid, 39.55% voids

Fig. 1—Packing configurations.

The effect of nonuniform particle size has also been studied.[3,4] Furnas[3] has determined mathematically the densities expected from dry, unbonded compacts consisting of 2, 3 and 4 components of varying relative size. Figure 2 shows the results of one set of calculations after converting Furnas' charts to rectangular coordinates. A number of parameters are used. The first is density plotted against ratio of the smallest to the largest particle size. This ratio is dimensionless as far as particle size is concerned and can be generally applied. This ratio has been converted to three typical sands with 20, 50 and 100 mesh grains as the largest particle. Density has been converted to lb/cu ft and weight of the 2-in. AFS sand specimen when dry.

Some important conclusions can be drawn from these mathematical calculations. Within the range of particle size and distribution of Fig. 2 (particle size ratio 1 to 0.01, 1 to 4 screen distribution), maximum density is obtained with a two component system (line 2, Fig. 2) when the 2 components differ in size sands. This is shown in Fig. 2. Within the range 20 to 325 mesh and the distribution of Fig. 2 it is theoretically possible to increase density from 60 to about 80 per cent solids with a two-component aggregate, only from 60 to 67 per cent solid with a four-component aggregate. However, if the range of particle size is extended to 1 to 0.0001 the reverse is true. As shown to the right of the break in the chart, it is then theoretically possible to increase density to 96 per cent solid with a four-component system. The limit with a two-component system is 85 per cent solid with this larger spread in particle size.

Another reason for this misconception is that although the three- and four-component distributions of Fig. 2 that correspond to three- and four-screen foundry sands are denser than a mass composed of a single particle size, less dense than a two-component system, this difference is due to the distribution of the particle sizes rather than to the number of size components. Figure 2 shows that there is little difference in density due to the number of particle sizes

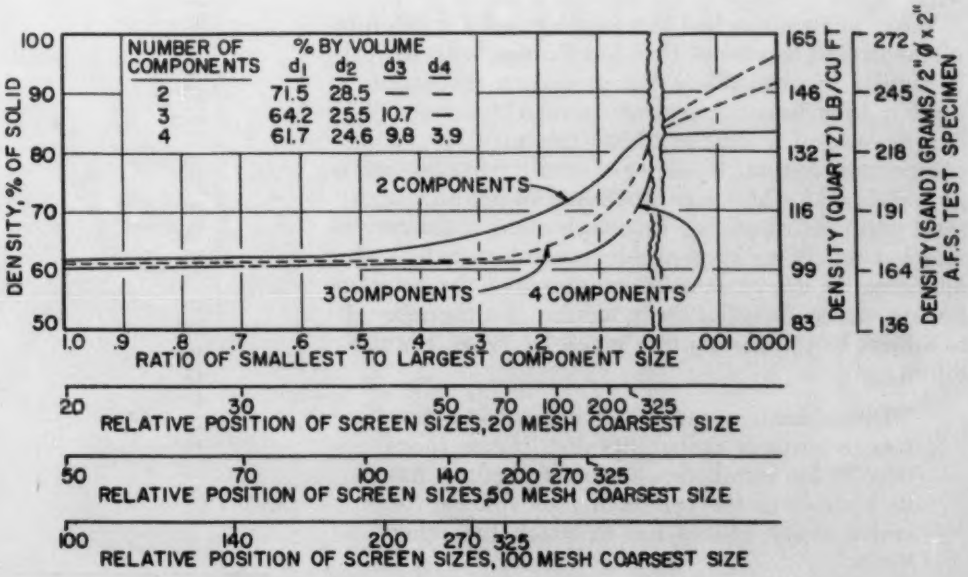
NUMBER OF COMPONENTS
% BY VOLUME
d1 d2 d3 d4
2 71.5 28.5 — —
3 64.2 25.5 10.7 —
4 61.7 24.6 9.8 3.9
2 COMPONENTS
3 COMPONENTS
4 COMPONENTS
DENSITY, % OF SOLID
100 90 80 70 60 50
DENSITY (QUARTZ) LB/CU FT
165 146 132 116 99 83
DENSITY (SAND) GRAMS/2"ø x 2" A.F.S. TEST SPECIMEN
272 245 218 191 164 136
1.0 .9 .8 .7 .6 .5 .4 .3 .2 .1 .01 .001 .0001
RATIO OF SMALLEST TO LARGEST COMPONENT SIZE
20 30 50 70 100 200 325
RELATIVE POSITION OF SCREEN SIZES, 20 MESH COARSEST SIZE
50 70 100 140 200 270 325
RELATIVE POSITION OF SCREEN SIZES, 50 MESH COARSEST SIZE
100 140 200 270 325
RELATIVE POSITION OF SCREEN SIZES, 100 MESH COARSEST SIZE

Fig. 2—Results of one set of calculations after converting Furnas' charts to rectangular coordinates.

until the particle sizes differ by a factor of two. In the average foundry sand this factor of two corresponds to a difference in grain size from 50 to 100 mesh. In order to increase density a difference in particle size from 2 to 10 is necessary, and no significant difference in density is obtained (within the limits of Fig. 2) until the particles differ in size by a factor of 5 to 10. Only then is a two-component system *one* method of significantly increasing density if such an increase is desirable.

Figure 2 shows only one method of changing density by means of distribution. There are other methods. One other is described mathematically by Wise[4] and summarized in the second part of this paper. There is good correlation between both methods and actual foundry sands, as described in other papers of this symposium.

Another important point is the effect of the largest particle size on density. Taking the simplest case, a two-component system, an addition of 28.5 per cent silica flour (200-325 mesh) should increase the density of a 20-mesh sand from 60 to 80 per cent solid. The same addition of silica flour to a 50-mesh sand increases the density from 60 to 72 per cent. This same addition to a 100-mesh sand increases the density from 60 to only 66 per cent solid.

Multiple-Screen Sand Advantages

It would seem from Fig. 2 and others like it that the chief advantage of a multiple-screen sand is not necessarily increased density, but controlled density, controlled density with a simultaneous controlled void size and permeability. It is again important to differentiate between void size and amount of voids. Both void concepts have their advantages and disadvantages in the foundry, depending on the application of these concepts.

The theoretical densities of Fig. 2 are higher than those obtained with actual sands in the papers to follow. This is to be expected for angularity, surface roughness, non-ideal distribution all decrease density. Actual densities should be expected to be lower than the theoretical. However, the theories of particle packing are invaluable as a guide on what to expect and why.

Wise[4] has approached this problem with a different mathematical treatment than has Furnas, with basically similar results. While the preceding discussion is limited to a four-component (screen) system, Wise has developed a mathematical treatment for multi-component system. Since most small particles are a probability distribution or stochastic (as are all foundry sand grain distribution), this work offers a theoretical solution to all packing problems. Unfortunately, the mathematics are extremely complex and the solution for any given distribution is tedious. Furthermore, it is subject to the assumption given by Wise. His definition is:

> "'Dense random packing' is defined in a new way in terms of probability distribution function W for tetrahedra; each tetrahedron has its vertices at the center of four spheres for which every sphere has to touch the other three."

Wise gives the maximum packing distribution in terms of the radii. Actually it is a bi-modal (two peaks) distribution. Since the mathematics for determining the density of any given particles size distribution is extremely complex, this discussion will be limited to the maximum packing (density) distribution. It was found that maximum packing was 80 per cent solid without filling the remaining interstitial space. By filling these interstices with fine (small radii) spheres a maximum possible packing of 87 per cent solid was calculated. The maximum packing distribution is given in Table 1.

Packing Independent of Grain Diameters

By examining the data in Table 1, several interesting conclusions can be drawn. The term, radius, in Table 1 is actually a ratio of radii. Thus the conclusion that packing is independent of diameters of grains. This same conclusion is reached from Furnas' theoretical work. In terms of foundry sand distribution, this would indicate that only the distribution is a necessary prerequisite for maximum packing, and it could be obtained with equal ease for either coarse or fine sand so long as their distribution conforms to the theoretical one.

All foundry sands are screened and their distribution reported on a geometrical scale of diameters. Table 1 indicates that maximum packing is a linear function of radii or diameters.

In Table 1 there are 26 class intervals (radius ratios) while in foundry sands there are 13 class intervals in normal nest of screens (6 mesh through AFS Clay). Therefore, this maximum packing distribution is more definitive than normal foundry sand distribution. Since experimentally with a foundry sand distribution it is not possible to obtain density near the theoretical, it is entirely possible that this failure is

TABLE 1

Radius (Ratio)	Frequency
5.0	0.19
4.75	0.10
4.50	0.19
4.25	0.29
4.00	0.38
3.75	0.57
3.50	1.14
3.25	1.33
3.00	1.90
2.75	3.04
2.50	4.18
2.25	6.66
2.00	8.56
1.75	11.03
1.50	15.69
1.25	15.40
1.00	13.88
.75	8.56
.50	1.90
.45	0.10
.40	0.19
.35	0.14
.30	2.00
.25	1.95
.20	0.57
.15	0.06
Total	100.00

TABLE 2

r/ro	AFS Screen	% Retained
4.25	20	0.5
3.00	30	3.5
2.10	40	17.1
1.50	50	19.6
1.05	70	31.1
0.75	100	13.9
0.53	140	8.6
0.38	200	2.2
0.27	270	2.1
0.20	Pan	2.0
Remainder	AFS Clay	0.6

TABLE 3

r/ro	AFS Screen	% Retained
4.25	30	0.5
3.00	40	3.5
2.10	50	17.1
1.50	70	19.6
1.05	100	31.1
0.75	140	13.9
0.53	200	8.6
0.38	270	2.2
0.27	Pan	2.1
Remainder	AFS Clay	2.6

due to the lack of a sufficient number of screens (class intervals) to accurately establish the maximum density distribution.

It is possible to translate the distribution given in Table 1 into a foundry sand distribution by combining several class intervals into one which matches the AFS screen series. The results are given in Tables 2 and 3. Table 2 was computed by letting the radius ratio 1.5 equal to 295 microns (AFS 50 mesh) and Table 3 by letting radius ratio 1.5 equal the AFS 70 mesh or 208 microns. It can be seen that the distributions are very similar; the only difference being the shifting of the entire distribution by one screen. Attempts to verify the maximum packing density of 87 per cent solid using these distributions experimentally have been unsuccessful, i.e., much lower densities were obtained than 87 per cent solid. However, the densities of these two distributions were higher than normally would be expected in foundry sands and their densities were equal within experimental error.

From the application of Wise's particle-packing theory to foundry sands, these general conclusions are warranted:

1) The maximum density of a foundry sand grain distribution is independent of the fineness:
2) There is a family of maximum density distributions:
3) Increased density is possible by increasing the definition (number of screens) in the foundry classification series.

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WRITTEN DISCUSSION IS SOLICITED

DENSITY OF SAND GRAIN FRACTIONS OF THE AFS SIEVE ANALYSIS

By
R. W. Heine* and T. W. Seaton**

In order to gain a better understanding of foundry sands and the effect of compaction upon them, a study was conducted involving sands selected to cover a broad range of distributions and AFS Fineness numbers. Sands selected were relatively clay free or washed and dried in order that the clay particles found in many sands would not interfere with the compaction of the sand grains.

The justification for this selection lies in the fact that it becomes necessary to learn and understand the compacting characteristics of clay free silica particles before beginning studies of clays and their effects on compaction of these same silica particles.

During the course of this work it was felt that a similar study of the individual fractions obtained when running the AFS Standard Sieve analysis might provide some additional interesting data.

PREPARATION OF SIEVE FRACTIONS

It was noted during the course of preparation of the sieve fractions that the fractions, as obtained when the AFS Standard Sieve analysis was run, were not sufficiently well defined so as to give the investigators accurate separation or well defined fractions. For example, it was found that when a sieve analysis was run on the fraction as obtained from running the Standard Sieve analysis, this fraction actually had a distribution of its own. The −40 +50 fraction, for example, when tested, showed only 76 per cent to be true or actual −40 +50 particles. The remaining 24 per cent was distributed on either side of the −40 +50 sized particles much as might be expected in a normal foundry sand. This condition existed with all of the fractions and the distribution was spread over more sieves on proceeding from the coarser to the finer fractions. In effect then, there is actually a distribution within a distribution in a standard sieve analysis. The sharp separation of the aggregate sample into individual fractions is not achieved.

SIEVE ANALYSIS

As a result of these findings, the fractions were rescreened many times in order to obtain as accurately defined fractions as possible. Figure 1 shows the sieve analysis of the fractions which were prepared for the study of jolting effects on compaction, which will be discussed further on. It is virtually impossible to achieve 100 per cent definition of fraction. It was felt, however, that fractions as well defined as those shown would be sufficiently accurate for this work.

As a further check on the accuracy of the fractions shown in Fig. 1, base permeabilities were run on the fractions and checked against the mathematically calculated permeabilities for 100 per cent defined fractions. Figure 2 shows the experimentally obtained base permeabilities compared with the mathematically calculated ones. It was felt that agreement of the data was extremely good. The fact that the experimentally obtained data fall slightly below the mathematically obtained curve is due to the fact that the fractions were not 100 per cent defined.

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METHODS OF COMPACTING SAMPLES

Three methods of compaction were investigated. These were, jolting, ramming and vibrating. Figure 3 shows the equipment used for obtaining the data presented in Figs. 9 and 10 dealing with compaction by jolting. It consists of a 100 cc graduated cylinder of known weight and an A.S.T.M. Standard Flow Table used by the cement industry. The table rises and drops through the action of a cam and insures consistent jolting energy at all times. The graduated cylinder in the table was filled to the 100-ml mark with the fraction to be tested. The cylinder was jolted the desired number of times and the volume then occupied by the sample was read directly from the graduated cylinder. Cylinder and sample were then weighed. The weight of the cylinder was subtracted from the total weight to give the weight of a known volume of sand. From this, then, was calculated the dry-packed density and per cent solid of the sample.

To obtain the data shown in Figs. 4-8, inclusive, the following procedures were used:

Loose density was determined by placing the dried sand in a 100-ml container, tapping the container lightly ten times to a level volume and then weighing the sand.

Wet density was determined by packing the sand immersed in water as densely as possible by repeated rapping of the container. The total volume of sand and water was equal to 100 ml. Total weight of 100 ml of sand and water mixture was determined. The weight of the water gives the void volume, or percentage, present in 100-ml of aggregate. The weight of the sand in the container divided by 100 gives the apparent density of the sand and, when multiplied by 62.4 lb/cu ft, gives the density of the sand in lb/cu ft. By dividing the density of the sand by 165.3, the percentage of solids in the aggregate may be obtained.

Furthermore, if the weight of sand in the 100-ml container is divided by 100 per cent minus the percentage of voids (i.e., the weight of water), then the specific gravity of the sand fraction is obtained. If the sand particles are pure silica and not porous, this specific gravity should equal 2.65. A specific gravity of 2.65 is the generally accepted chemistry handbook value for silica. Thus this method of determining the packing of the sand grains affords an internal check on both the true percentage of solids present, and also on the purity and soundness of the silica present.

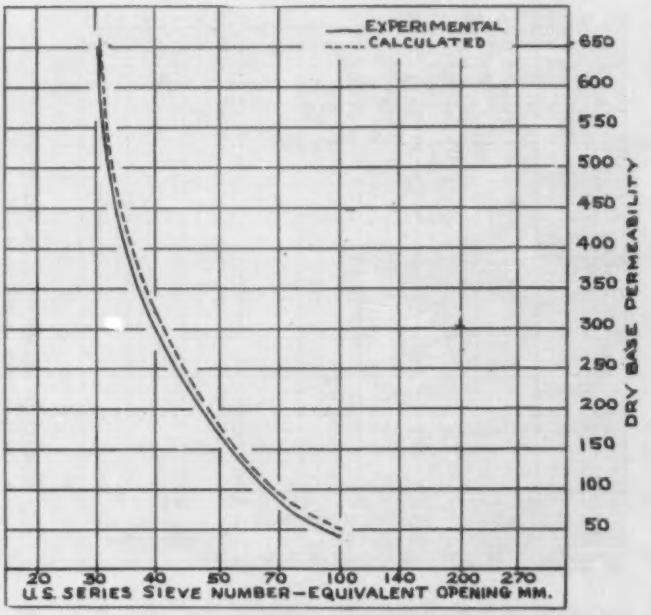

Fig. 2—Comparison of experimentally obtained base permeabilities with those mathematically calculated.

Fig. 3—Jolting equipment used to obtain compaction.

FIGURE 1—SIEVE ANALYSIS OF FRACTIONS

Minus 30 Plus 40 Fraction		Minus 40 Plus 50 Fraction	
U. S. Series Sieve No.	% Retained	U. S. Series Sieve No.	% Retained
30	0.15	40	0.65
40	95.03	40	97.65
50	4.78	70	1.63
70	0.04	100	0.06
100	0.02	Pan	0.01
140	0.01		
200	0.01		
270	0.01		

Minus 50 Plus 70 Fraction		Minus 70 Plus 100 Fraction	
U. S. Series Sieve No.	% Retained	U. S. Series Sieve No.	% Retained
40	0.04	40	0.02
50	2.60	50	0.01
70	93.90	70	0.70
100	3.30	100	97.65
140	0.14	140	1.66
200	0.04	200	0.01
270	0.01	270	-----
PAN	0.01	PAN	-----

Minus 100 Plus 140 Fraction	
U. S. Series Sieve No.	% Retained
40	0.10
50	0.08
70	0.06
100	7.21
140	89.02
200	3.50
270	0.02
PAN	0.01

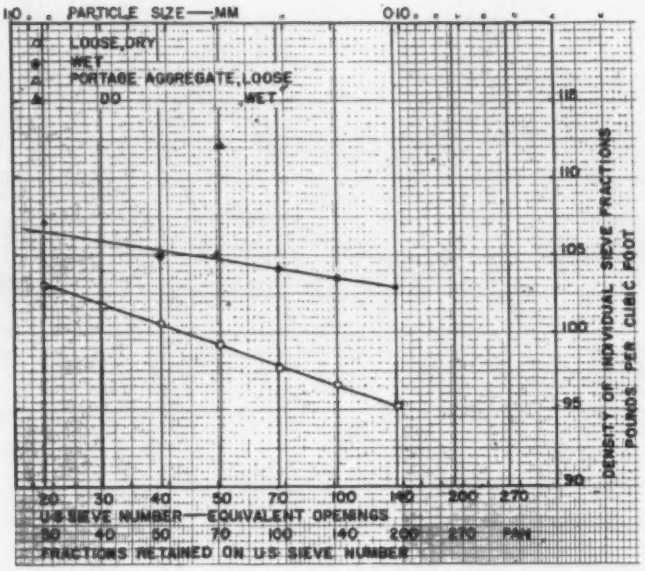

Fig. 4—Plot of data obtained on fractions of a Wisconsin silica sand.

Other methods were tried for compacting the samples, but the two methods described above gave the best duplication of results.

Dry rammed density, shown in Fig. 10, was obtained by forming the AFS Standard 2 x 2-in. specimen with three drops of the rammer and weighing the amount of sand required to form the specimen. Knowing the weight of sand for a known volume permits calculation of the density in lb/cu ft.

In all calculations herein reported, a density of pure silica at 100 per cent solid of 165.3 lb/cu ft, was used. True specific gravity was taken as 2.65. On the basis of pure silica, the apparent density of the sand in lb/cu ft divided by 165.3 gives the percentage solids present. For example, if a sand weighs 100 lb/cu ft, then (100 ÷ 165.3) × 100 per cent = 60.4 per cent solids, and the balance 39.6 per cent is voids.

DISCUSSION OF THE DATA

Five sands were involved in the first phase of this work, and dry and wet packed densities for the various fractions of these aggregate sands were obtained.

The five sands selected were as follows:

1) Portage Wisconsin silica sand
2) Wedron silica sand
3) Juniata sand
4) Michigan City sand
5) Larson bank sand

Figure 4 is a plot of the data obtained on fractions of a Wisconsin silica sand. When plotted on semi-logarithmic paper the data gave a straight-line relationship. It will be noted that in all cases the wet-packed densities are higher than the loose dry-packed densities. The loose, dry density represents the density of the sand with no special effort to obtain nesting together of particles, i.e., packing. In other words, this is approximately the density obtained when the dry sand is loaded into a hopper or other container. The wet density, on the other hand, represents the highest density which the experimenter could achieve by the method of packing employed. It represents an upper limit of density resulting from the nesting together of particles which is not likely to be obtained by any method of packing which is presently used in the foundry industry.

Densities were also run on the complete aggregate sample (complete distribution before breakdown into individual fractions), as a matter of interest and are plotted as separate points on the graph. The density of the aggregate compared with the density of an individual fraction of the same particle size shows the extent of packing which occurs in the aggregate.

Figure 5 is a plot of the density of the fractions obtained from an Ottawa sand compared with the information from the Wisconsin silica sand recorded in Fig. 4.

The agreement of the data for these two sands is extremely good, and tends to bear out the similarity of the two sands. It was felt that such duplication gave added emphasis to the importance of this work.

Figure 6 is a plot of the data obtained from the fractions of a Michigan bank sand (Juniata). The dry-

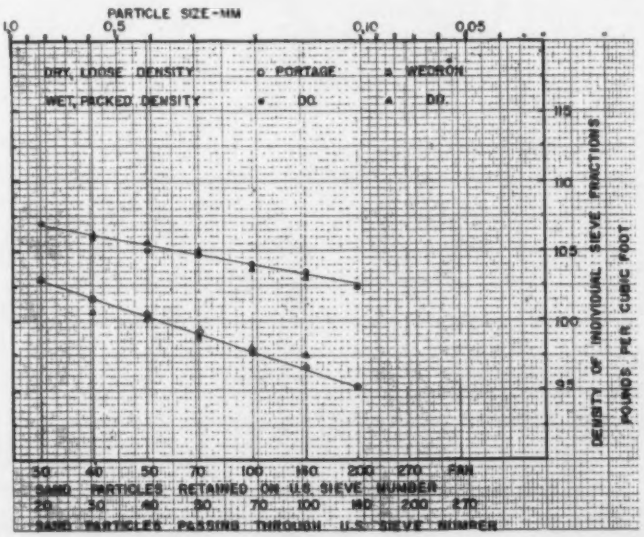

Fig. 5—Plot of density of fractions obtained from Ottawa sand compared with Wisconsin sand (Fig. 4).

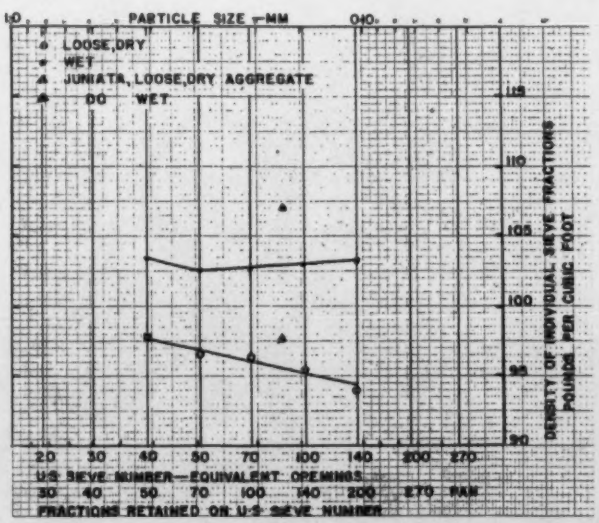

Fig. 6—Plot of data obtained from fractions of a Michigan bank sand.

packed density was a straight-line relationship, as was expected. The wet-packed density curve, however, showed a slight increase in density as the fineness of the fractions increased beyond the −50 +70 fraction. The explanation for this will be covered in a discussion of Figs. 7 and 8.

Figure 7 is a plot of the densities as obtained on a Michigan City sand. It will be noted that the upward swing in density beginning with the −70 +100 fraction and continuing with the finer fractions is more pronounced than was the case with the Michigan bank sand.

Figure 8 is the plot of the densities obtained from the fractions of a Wisconsin bank sand (Larson). Again, the finer fractions exhibited this peculiar upward trend in density which was contrary to what would have been expected. In the case of this sand, the upward swing of the curve took place on the −100 +140 fraction for wet-packed density, and on the −140 +200 fraction for the dry-packed density.

A microscopic examination of these fractions revealed the presence of varying amounts of dark-colored particles which appeared to be iron oxides. They were more prevalent in the finer fractions. It was found that some of these particles were rather strongly magnetic and could be removed, but others were not attracted magnetically. This seemed to indicate the presence of both ferrous and ferric oxides which differ rather broadly in their magnetic properties.

IRON DETERMINATION

A chemical analysis was run to determine iron present in the 200-mesh fractions of the Wisconsin bank sand and the Michigan City sand. While some iron was observed in the Michigan bank sand there did not appear to be as much present as in the two sands mentioned above.

The chemical analysis revealed that the 200-mesh fraction of the Wisconsin bank sand contained 12.4 per cent iron when calculated as Fe_2O_3, and the 200-mesh fraction of the Michigan City sand contained 7.4 per cent iron when calculated as Fe_2O_3. Since the specific gravity of Fe_2O_3 is about 5.18 as compared with 2.65 for SiO_2, this would explain why the densities of the finer fractions of these sands did not follow the packed-density patterns of the sands of Figs. 4 and 5, known to be nearly free of iron oxide.

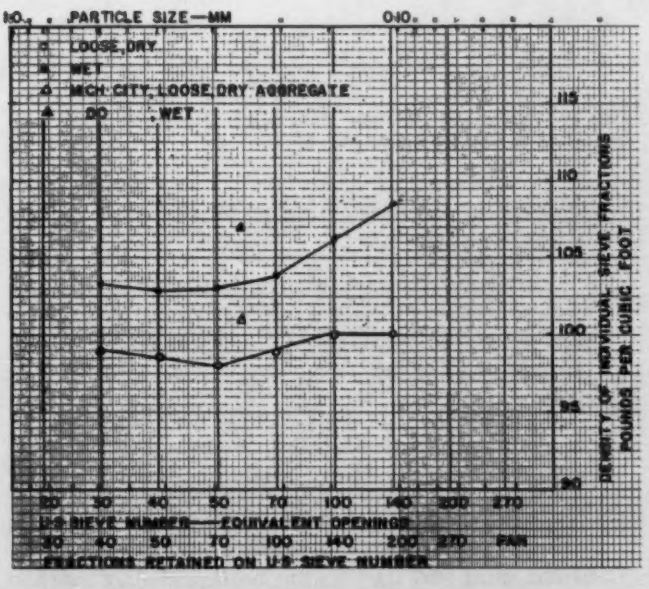

Fig. 7—Plot densities obtained on a Michigan City sand.

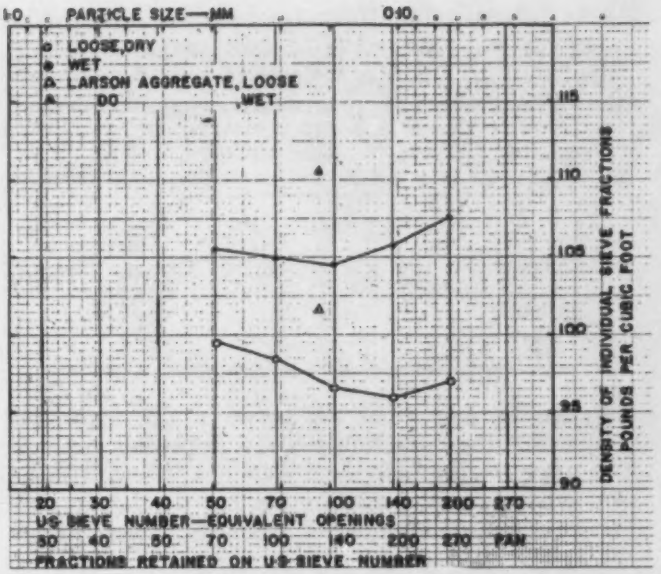

Fig. 8—Plot of densities obtained from fractions of a Wisconsin bank sand.

The difference in the slope of the curves in Fig. 6 is due to the fact that wet density represents more perfect packing and more truly reflects the presence of non-silica particles than does the loose dry-density determination. The microscopic examination indicated that the amount of iron oxide present in the Juniata sand was less than in the Larson and Michigan City sands. Since the wet-density determination gives more perfect packing and is more sensitive to the presence of non-silica particles, the presence of the iron oxide was indicated by this method. The amount of iron oxide present was apparently not sufficient to be reflected in the loose dry-density determinations.

SAND DENSITIES VS. JOLTING ENERGY

The next phase of the work involved the study of the densities of fractions obtained from an Ottawa sand under the effect of varied amounts of jolting energy. The fractions tested are those shown in Fig. 1.

Figure 9 is a plot of the density data obtained in this study. Three important points were brought out during the course of this work. In general, these same three factors apply to aggregate samples of sand.

1) Density decreases as fineness of the fractions increases.
2) As jolting energy is increased, density increases, up to a point. It was found that when jolting energy was increased beyond the points indicated on the graph, density began to drop off. This would seem to indicate that we reach a point of maximum compaction by applying jolting energy and can not go beyond this point. This, so far as this investigation is concerned, is true for clay-free or relatively clay-free sands.

3) As fineness of the fractions increased, less jolting energy was required to achieve maximum density.

Included on Fig. 9 is the plot of a sand (designated as 105-S) whose sieve analysis was as follows:

U. S. Series Sieve No.	% Retained on
40	1.93
50	8.15
70	7.80
100	20.63
140	32.21
200	17.47
270	8.74
Pan	3.07

It can be seen from the curve of this aggregate sample that the same fundamental principles apply to it as apply to the individual fractions. It can also be seen what influence distribution has on the density. This relatively fine sand had a density pattern nearly

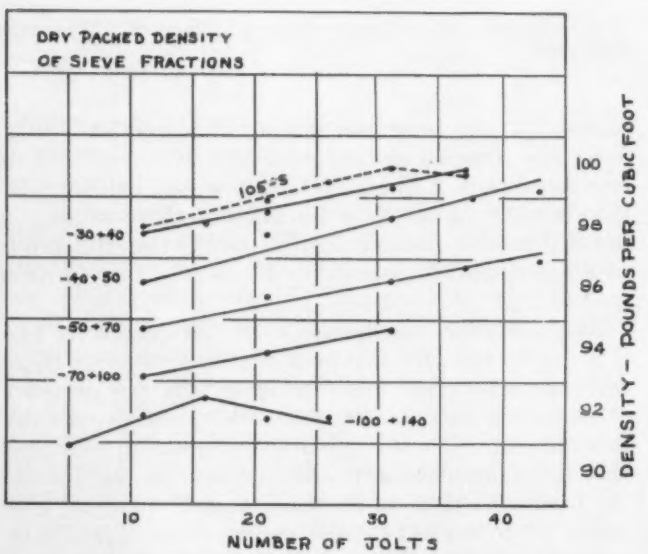

Fig. 9—Plot of the density data obtained in this study.

equal to that of the coarsest (−30 +40) fraction investigated. The influence of sand-grain distribution on density of the aggregate is a subject of other work being studied.

Figure 10 is a plot of the rammed densities of the same sieve fractions that were used to obtain the data in Fig. 9. Here, again, even though the method of compacting the sample is ramming instead of jolting, the density decreases as the fineness of the fractions increases.

SUMMARY

A study has been made of the effects of ramming, jolting and vibrating on the density of the various sieve fractions obtained in running the AFS sieve analysis. These fractions were rescreened as many as ten times in order to obtain better definition, since it was felt the data obtained from more accurately separated fractions would be of greater value.

Densities were obtained for dry and wet packing of the fractions and plotted so that the data could be evaluated. In all cases, densities were obtained in such a manner that good duplication of results was obtained.

Density data were also collected on the sieve fractions at various levels of jolting energy.

CONCLUSIONS

1) The density of sieve fractions decreases as fineness increases, regardless of the method used for compaction when high-purity silica sand grains are used.
2) The density of sieve fractions increases as fineness decreases, regardless of the method used for compaction.
3) Presence of iron oxides in sands has the effect of increasing density of the fractions beyond the densities obtained for comparable fractions of relatively pure sands.
4) Regardless of the size and shape of the sand grains, the relationship between compacting energy and density remains the same. This, of course, is true of sands relatively free of non-silica particles.
5) As fineness of the fractions increased, maximum density was achieved with less applied jolting energy.
6) After maximum density was reached, additional application of energy only resulted in a reduction of density of the mass.

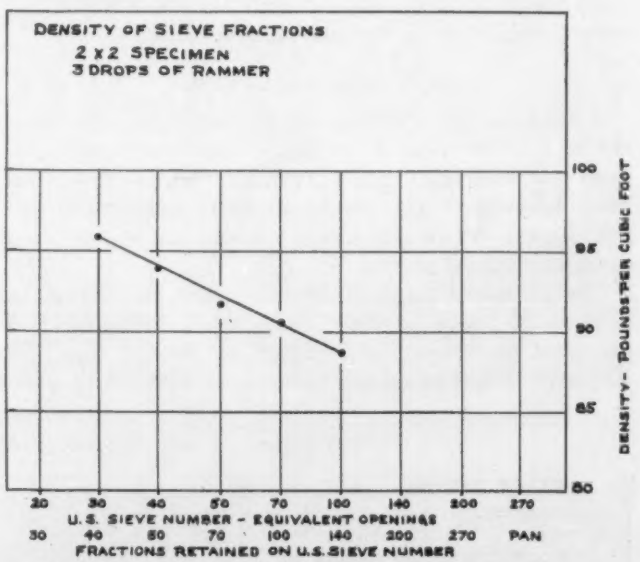

Fig. 10—Plot of the rammed densities of the same sieve fractions used to obtain data in Fig. 9.

7) Of particular interest was the fact that it was possible to achieve higher densities when the samples were vibrated than could be achieved by either jolting or ramming.
8) The results of this work are in no way intended to evaluate the desirability of using either high- or low-density sands in foundry operations.
9) The curves relating density to sieve fraction (Figs. 4 through 8) provide a profile view of the purity of the sand and its packing behavior. Any marked deviation from the curve for pure silica particles

indicates an important change in the sand such as purity, particle shape or porosity.

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WRITTEN DISCUSSION IS SOLICITED

IMPROVING ELECTRIC FURNACE REFACTORY LIFE BY SPECIAL SHELL COOLING TECHNIQUES

By
Vernon J. Howard*

ABSTRACT

This paper concerns the cooling system of the electric furnace equipment at Oklahoma Steel Castings Co. The standard cooling glands, along with variations from standard design will be covered so that the reader may have a complete picture of the entire cooling system. The benefits derived from the variations are summarized to justify their adoption by the author's company.

Special shell cooling techniques have been considered at the plant with which the author is associated for many years. The progress and development of ideas along these lines have been cautious due to the obvious danger of bringing molten metal and water together. In the past 5 years direct progress has been made with the results sufficiently encouraging to report in this paper.

The equipment described is a 2-ton, direct-arc, top-charge, acid-lined furnace employing an 8-in. electrode (Fig. 1). The furnace is covered with a dust collector. The average size of the heats produced is 7,700 lb. This unit is powered by a 2,000 KVA transformer and is used for high-speed production, producing all types of steel from plain carbon to A.I.S.I. 347 stainless. On a full-production schedule, it is geared to produce a heat every 65 min with 22 heats scheduled per day.

The roof is laid up with special shape silicon brick, using expansion joints equaling 3/8-in. to the foot. The center section is cemented in place. Lack of space prevents the prescribed soaking and preheating of the new roof so it is placed on the shell direct from the form.

In 1952, the first year that the melting department operated on an incentive system, various forms of statistical controls were set up. The primary purpose was to preserve the quality of the steel through the anticipated drive for greater speed and higher ratios. Along with chemical and temperature controls, records of delays were maintained showing the cause and length of the shut down. Analysis of these records revealed that the principal cause of delay was trouble with the water coolers. This cost 1,354 min

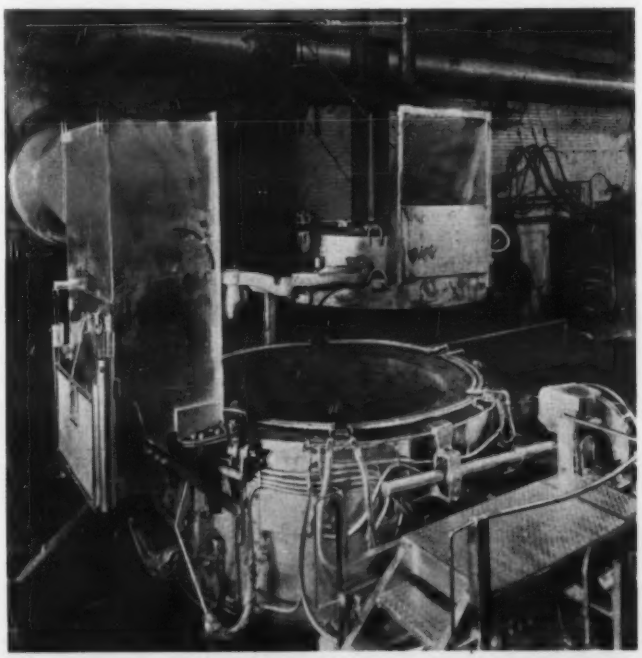


Fig. 1—Two-ton, direct-arc, top-charge, acid-lined electric furnace.

in delays for the year, or practically one full working day. Roof designs were changed to eliminate the flange on the outer edge of the ring (Fig. 2).

The electrode ring coolers were redesigned, reversing the taper of the inside wall and decreasing the wall thickness to allow a greater flow of water to pass through the chambers (Fig. 3).

In 1953 with these changes effected there were 431 min in delays reported, or a decrease of 923 min. This was enough time at the present melting rate to produce 55 tons of metal while the furnace was down for repairing water lines the previous year.

The ring coolers that are placed between the shell and the roof are laid up in five sections with U-joints at each section for quick replacement (Fig. 4). The water enters through a 1/2-in. connection and goes out through a 11/32-in. connection. These smaller outlets insure that the gland will be filled with water and has practically eliminated cooler burnouts.

*Melting Foreman, Oklahoma Steel Castings Co., Div. American Steel & Pump Corp., Tulsa, Oklahoma.

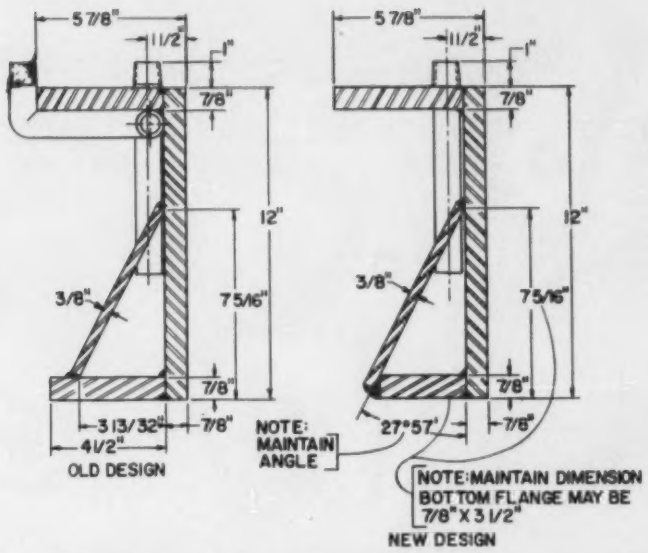


Fig. 2—Roof ring. Flange on outer edge of ring was removed to eliminate a hot spot which caused cracking. Due to the new design of the ring the pipe was eliminated because it did not come in contact with any of the roof brick.

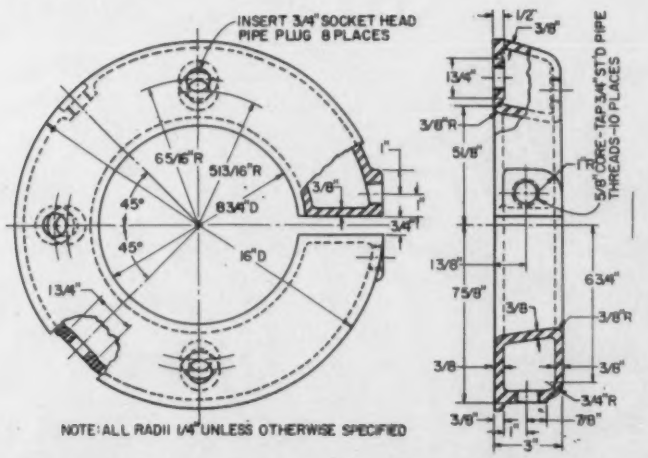


Fig. 3—Electrode cooling ring. This cooler is cast in nodular iron. Wall thickness of gland was decreased to insure more circulation of water. Inside diameter was tapered to keep it free of oxides, thus insuring free movement of the electrode.

The progress made on the cooling system through the concentrated efforts of the entire personnel was indeed gratifying, and it was only natural to proceed further with shell cooling to prevent the damaging hot spots that were experienced in the furnace lining. As it will be noted in Fig. 1, the furnace is designed with a short arm on *B* or the center phase. It was directly opposite this phase that the hot spot was occurring, and it was necessary to patch this area constantly in order to attain substantial refractory life. It is the writer's opinion that this design is prone to more conductor trouble, consequently it is more difficult to equalize the current. The cooler design shown in Fig. 5 was chosen to be placed over the troublesome area.

During the 18 months following the installation of the gland, numerous backings were used between the shell and the lining brick. Observations and measurements of lining thickness were studied after each relining period. The hot-spot area held its own with the balance of the lining and, in most cases, showed about an inch more thickness. This was accomplished without the patching mentioned previously. The backing chosen was loose, dry ganister.

REFRACTORY THICKNESS

Being well aware that one gland could not answer all of our problems, such as the effect on KWH and shell temperature when the lining reached a critical thickness, we proceeded with the installation of the glands around the entire shell. At the outset we were too cautious by removing the lining before we realized how long the refractory would hold its thickness at a given point. A short explanation as to the nature of this caution might be in order. At the time the cooler installations were made the plant was operating 6 days a week around the clock. In analyzing a lining it was necessary to determine whether it would hold a full work week. In many instances linings were removed that might have run the full week. It was only when production was curtailed that we began gambling in an effort to equalize or lower our refractory cost, due to the 24 per cent increase in material cost since 1955 and the anticipated lower life due to intermittent operation. It was through these efforts that we realized the thickness of the lining would hold fairly constant at 3½ to 4 in. This thickness would be reached at 250 to 300 heats.

The next step was to determine whether the glands were affecting the kilowatt-hour consumption. At this writing we are operating 15 hr, producing 14 heats per day.

During the 9 hr shut-down period and on week ends the furnace is held to a cherry red by placing an atmospheric burner in the tap hole. The average kilowatt hour consumption during a 2-month period was 445 KWH per ton. In order to find a 2-month period of similar operation it was necessary to go back to 1954, during which period the consumption

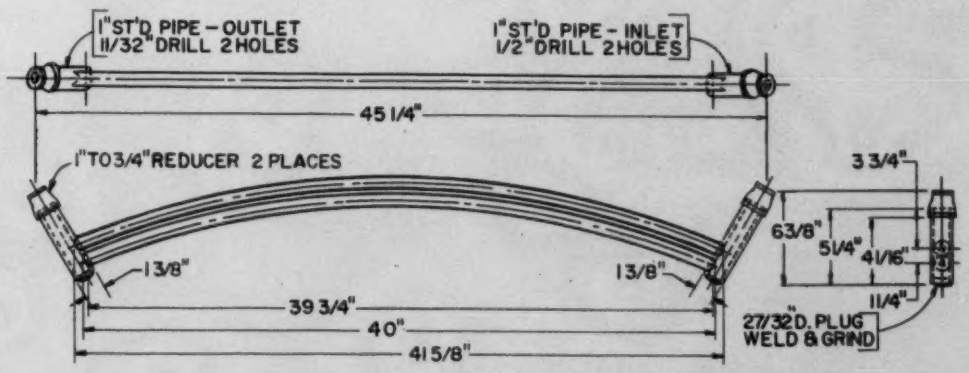


Fig. 4—Ring cooler. Purpose of decreasing the outlet on the ring was to eliminate the air bubbles which caused the hot spots in the coolers.

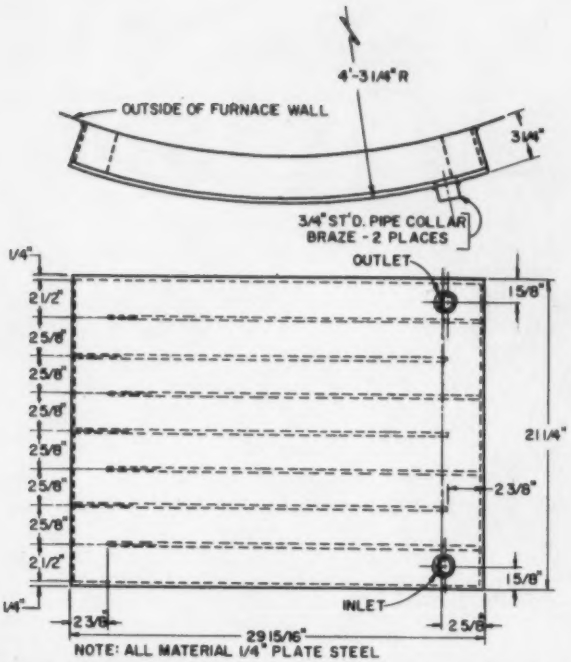


Fig. 5—Shell cooler. Purpose of water inlet at base of gland is to insure a full chamber of water.

was 453 KWH per ton. Consequently, we feel that the power input was equal and had not been affected by the addition of the cooling glands.

Another factor of prime importance in a jobbing shop was the effect of the cooling with a thin lining in relation to attaining desired tapping temperatures. Our main concern was directed at the possibility of a longer melting cycle. The KWH comparison in the preceding paragraph for the most part eased our concern. However, to substantiate this the average pounds melted per minute was 115.67 in 1955 compared to 118.23 during the past 12 months. This increase was attained in spite of variables in operating procedures which tended to lengthen the heat cycle rather than shorten it.

These same variables made it necessary to come in the side door in an effort to find the economy of shell cooling. A change in weight distribution in the plant resulted in 30 per cent of production being poured through 270-lb monorail pots. This, along with increased production of shell molds, raised the average tapping temperatures from 3019 F in the days prior to shell cooling to the present 3073 F, and many heats were required above 3100 F. Furthermore, low-carbon high-alloy production increased from an occasional heat to 5 per cent of total production. The temperatures mentioned were taken with an immersion pyrometer read from a spoon 6-in. in diameter.

During 1955, prior to these changes, and with the furnace operating with one cooling gland on a 6-day round-the-clock operation, the average lining life was 331 heats and the roof life was 487 heats. During the 15-hr 5-day operation, the lining life has increased to 358 heats. In an effort to fully accentuate the amount of increase it is necessary to point out that the roof life has decreased 81 heats, which we feel is normal due to the aforementioned variables and the intermittent operation.

We are convinced that shell cooling properly applied can increase refractory life. In fact we have since started experimenting with the local exhaust type roof and the possibilities of a simple cooling system.

AFS Foundry Show To Feature Latest Through Working Exhibits

Approximately 80 out of more than 200 AFS Foundry Show exhibitors will feature working exhibits demonstrating the latest in metal casting equipment and techniques. These exhibits will be strategically located throughout all halls of the Cleveland Public Auditorium to provide a constant and well distributed flow of visitors in all areas during the week May 19-23.

Operating exhibits will cover every phase of foundry operations, from the unloading of molding sands to cleaning and final inspection of castings. Each display will be designed to inform casting producers of the latest equipment advances. They will serve as a "point of sale for foundry products," the theme of the Show.

Emphasis on the CO_2 process comes from four companies with operating displays. Another four firms will have working exhibits dealing with the shell process. At least five will deal with materials handling, and others will demonstrate pneumatic handling of sand.

Other relatively new processes, techniques or equipment to be featured will be the Shaw process, the use of epoxy resins in patternmaking, direct-reading spectrometers, core blowers, and core shooters.

Several companies with operating exhibits are entering the Foundry for the first time. However, the majority of the companies have participated for a number of years.

Partial exhibitors list as of Jan. 1.

Acme Resin Corp., Forest Park, Ill.
Adams Co., Dubuque, Iowa
Air Reduction Sales Co., New York
Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Flexible Coupling Co., Westfield, N. Y.
Allied Chemical & Dye Corp., New York
Allis-Chalmers Mfg. Co., Milwaukee
Alloy Metal Abrasives Co., Ann Arbor, Mich.
American Air Filter Co., Louisville, Ky.
American Alloys Corp., Kansas City, Mo.
American Chain & Cable Co., Bridgeport, Conn.
American Colloid Co., Chicago
American Fire Clay & Products Co., Canfield, Ohio
American Foundry Flask Co., Kansas City, Mo.
American Gas Association, New York
American Marietta Co., Wheeling, Ill.
American Metal Market Co., New York
American Refractories & Crucible Corp., North Haven, Conn.
American Silica Sand Co., Ottawa, Ill.
American Smelting & Refining Co., New York
Apex Smelting Corp., Chicago
Applied Research Laboratories, Glendale, Calif.
Arcair Co., Lancaster, Ohio
Archer–Daniels–Midland Co., Cleveland
Arrowhead Co., Chesterton, Ind.
Baroid Div., National Lead Co., Chicago
Barrett Div., Allied Chemical & Dye Corp., Toledo, Ohio
C. O. Bartlett & Snow Co., Cleveland
Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago
Beryllium Corp., Reading, Pa.
Blastcrete Service Co., Los Angeles
Blaw–Knox Co., Pittsburgh, Pa.
Bradley Washfountain Co., Milwaukee
British Industries Corp., Port Washington, N. Y.
British Moulding Machine Co., Faversham, Kent, England
Brown Fintube Co., Elyria, Ohio
Brush Beryllium Co., Cleveland
Burr Aluminum Products, Burr Oak, Mich.
C & S Products, Detroit
Campbell–Hausfeld Co., Harrison, Ohio
Canton Chaplet & Chill Co., Canton, Ohio
Carborundum Corp., Niagara Falls, N. Y.
Carl Mayer Corp., Cleveland
Carrier Conveyor Corp., Louisville, Ky.
Carver Foundry Products, Muscatine, Iowa
Centrifugal Castings Machine Co., Tulsa, Okla.
Clark Equipment Co., Battle Creek, Mich.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Flux Co., Cleveland
Cleveland Metal Abrasive Co., Cleveland
Cleveland Vibrator Co., Cleveland
Continental Copper & Steel Industries, Buffalo, N. Y.
Corn Products Sales Co., New York
Davenport Machine & Foundry Co., Davenport, Iowa
Davey Compressor Co., Kent, Ohio
Davis Fire Brick Co., Columbus, Ohio
Dayton Oil Co., Dayton, Ohio
Delhi Foundry Sand Co., Cincinnati
Delta Oil Products Co., Milwaukee
Demmler Mfg. Co., Kewanee, Ill.
Dependable Pattern Works, Portland, Ore.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
Devcon Corp., Danvers, Mass.
Diamond Alkali Co., Cleveland
Harry W. Dietert Co., Detroit
Dike–O–Seal, Inc., Chicago
Joseph Dixon Crucible Co., Jersey City, N. J.
Durez Plastics Div., Hooker Electrochemical Co., N. Tonawanda, N. Y.
Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago

Continued on page 76

CONTENTS

Foundry Show 71
Castings Congress 72
Nominations 72
AFS Awards 72
T&RI Program 74
International Congress . 76
Wisconsin Regional 77
Southeastern Regional . 77
Chapter News 79
Chapter Calendar 81
Personalities 82

AFS 1896

NEWS and VIEWS

National News

Committees Reviewing Technical Papers for 62d Castings Congress

Technical papers on a wide-range of foundry interests, from fundamental research to operational techniques, continue to be submitted for presentation at the AFS 62d Castings Congress to be held in Cleveland, May 19-23.

After papers are recorded at the National Office in Des Plaines, Ill., they are turned over to the Program & Papers Committees of the respective divisions for their review and approval.

Many of the technical papers will be preprinted in MODERN CASTINGS. Three papers were published in the January issue and five will appear in February. Included will be a paper from the British Cast Iron Research Association entitled *"Gases in Cast Iron with Special Reference to Pickup of Hydrogen from Sand Molds."* Authors are J. V. Dawson and L. W. L. Smith of the British association.

As of Dec. 31, a total of 48 papers had been submitted for approval. The titles of the first 25 were carried in previous issues of MODERN CASTINGS.

The latest 23 papers include seven on magnesium and aluminum, three on cast iron, and two dealing with sand.

Papers include:

"Ladle Heating in the Foundry."
"Tensile Properties of Microshrinkage—Graded AZ 63 Magnesium Alloy."
"A Study of the Foundry Characteristics of an Expendable Carbonaceous Mold Materials."
"A Study of the Ferritization of Nodular Iron."
"The Controlled-Slag Hot-Blast Cupola."
"Formation of Graphite in Cast Iron."
"Formation of Pearlite and Ferrite in Cast Iron."
"Formation of Undercooled Graphite in Cast Iron."
"Improvement of Casting by Press Forging."
"The Design of Plant Fluidimeter."
"Steel Making Practice for Quality Castings."
"Foundry Practice for Sand Casting Commercially Pure Aluminum."
"Aluminum Permanent Mold Casting Technique."
"Compaction Characteristics of Silica Sands."
"Theoretical Concepts of the Packing of Small Particles."
"Shell Molding for Steel Castings."
"Performance of Chills on High Strength Magnesium Alloy Sand Castings of Various Section Thicknesses."
"Rigging Design of High Strength Magnesium Alloy Castings."
"An Improved Design for Cast Tensile Bar Molds."
"A Little Knowledge of Plastics."
"Effect of Cooling Rate on the Grain Size of Magnesium Casting Alloys."
"Induction Melting in a Magnesium Sand Foundry."
"Studies on Cast Non-Ferrous Alloy as a Function of Section Thickness."

Northeastern Ohio Picks Shop Course Committee

■ Seven members of the Northeastern Ohio Chapter have been named to the Chapter Shop Course Committee which will assist in the shop course program of the 62d Castings Congress & Foundry Show.

Frank C. Cech, Max S. Hayes Trade School, is chairman. Other members are:

James G. Goldie, Max S. Hayes Trade School.

Donald Gross, Fred Fuller, Inc.

L. H. Heyl, Federal Foundry Supply Co.

James J. Schwalm, Federal Foundry Supply Co.

John Sharritts, Jr., John A. Sharritts & Co.

Walter J. Siebert, Cleveland Standard Pattern Works.

Frank C. Cech

Nominate Officers and Directors

Lewis H. Durdin, Dixie Bronze Co., Birmingham, Ala., has been nominated President of the American Foundrymen's Society for the year 1958-59. Now Vice-President, he was named to succeed the present President, Harry W. Dietert, H. W. Dietert Co., Detroit, by the Nominating Committee at a meeting held in Chicago, Dec. 9.

Charles E. Nelson, Dow Chemical Co., Midland, Mich., was named to succeed Durdin as Vice-President for the 1958-59 term.

The following were nominated to serve three-year terms as Directors of the Society:

■ David W. Boyd, Engineering Castings, Inc., Marshall, Mich., representing Gray Iron and Steel. (Region II, Chapter Group I, Central Michigan Chapter.)

■ Thomas W. Curry, Lynchburg Foundry Co., Lynchburg, Va., representing Gray Iron. (Region I, Chapter Group B, Piedmont Chapter.)

■ Richard R. Deas, Jr., Hamilton Foundry & Machine Co., Hamilton, Ohio, representing Gray Iron. (Region II, Chapter Group G, Cincinnati District Chapter.)

■ Jake Dee, Dee Brass Foundry, Houston, Texas, representing Brass & Bronze. (Region IV, Chapter Group P, Texas Chapter.)

■ Webb L. Kammerer, Midvale Mining & Mfg. Co., St. Louis, representing Equipment & Supplies. (Region IV, Chapter Group N, St. Louis District Chapter.)

■ H. M. Patton, American Hoist & Derrick Co., St. Paul, Minn., representing Gray Iron, Steel, and Patterns. (Region III, Chapter Group K, Twin City Chapter.)

New officers and directors of the Society will be elected at the Annual Business Meeting in Cincinnati, May 21, and will take office the day following the close of the 1958 Annual Castings Congress and Foundry Show, May 19-23.

At any time up to 45 days prior to the date of the Annual Business Meeting, additional nominations may be made by written petition signed by 200 members in good standing and filed with the AFS Secretary at the Central Office.

AFS Awards Highest Honors to Nine for Contributions to Society and Industry

■ Nine awards for outstanding contributions to casting industry have been approved by the AFS Board of Directors. The awards were recommended by the 1957-58 Board of Awards and unanimously approved by the Board of Directors through letter ballot.

Presentations will be made at the AFS Castings Congress to be held May 19-23 at Cleveland. The three Gold Medal winners will receive their awards at the Annual Banquet, May 21. The three Awards of Scientific Merit and three Service Citations will be presented at the Annual Business Meeting, also on May 21.

Gold Medal Awards

Ralph A. Clark, Electro Metallurgical Co., Div. Union Carbide Corp., Cleveland. The THOMAS W. PANGBORN MEDAL . . . "For outstanding contributions to the Society and Ferrous Casting Industry, especially in the field of Gray Iron Metallurgy."

Howard J. Rowe, Aluminum Co. of America, Pittsburgh, Pa. The WILLIAM H. MCFADDEN GOLD MEDAL . . . "For outstanding contributions to the Society and Light Metals branch of the Castings Industry

Wm. W. Maloney, General Manager & Secretary-Treasurer, American Foundrymen's Society, Des Plaines, Ill. The JOSEPH S. SEAMAN GOLD MEDAL . . . "For enthusiastic leadership and completly unselfish devotion to the Society as its Secretary and General Manager."

Awards of Scientific Merit

Melvin H. Horton, Materials Engineering Div., Deere & Co., Moline, Ill. . . . "For technical contributions over many years to the Gray Iron and Sand Division of the Society."

Kenneth F. Priestly, Vassar Electroloy Products, Inc., Vassar, Mich. . . . "For long and conscientious effort in the development of the Gray Iron Shop Course programs at the AFS Annual Castings Congress."

Franklin B. Rote, Albion Malleable Iron Co., Albion, Mich. . . . "For noteworthy contributions to the AFS Malleable Division in furthering the technical prestige of the Society."

AFS Service Citations

Frank S. Brewster, Brumley-Donaldson Co., Huntington Park, Calif. . . . "For valuable service to the Society and the Castings Industry in the development and dissemination of basic Sand Technology."

Ernest T. Kindt, Kindt-Collins Co., Cleveland . . . "For faithful and continuous service to the Society and the Patternmaking branch of the Castings Industry."

Fred G. Sefing, Development & Research Division, International Nickel Co., New York . . . "For long and conscientious service to AFS and the Castings Industry in fostering Foundry Educational Programs at all levels."

By-Laws of Society Due for Periodic Revision

General revision of the Society's by-laws is now under way to become effective July 1, 1958. A By-Laws Revision Committee, appointed by the President last August, met January 17 in Chicago and completed recommendations to be passed on by the Board of Directors in meeting February 24-25.

Once approved by the Board, the proposed revisions will be printed as a letter ballot and marked to the voting membership early in March, to be returned within 30 days.

A special judging committee then will make a physical count of all ballots cast, and final report will be made at the Annual Business Meeting to be held May 21 during the Cleveland Convention.

General revisions of AFS by-laws have been felt advisable about every four years, recent revisions being effective in December 1953, July 1948, July 1944. In 1953 a record total of 2,683 ballots were cast, of which 2,482 full ballots were in favor of all revisions. The 1953 revision established Regions of the Society, increased the Board of Directors to 24, and also provided for Junior memberships.

T&RI Trustees Recommend Broad Program Expansion

Trustees of the AFS Training & Research Institute at their Dec. 11 meeting held in Chicago, recommended that the AFS Board of Directors proceed with construction of a Foundry Training Center building adjacent to the present Central Office at Des Plaines, Ill. At the same time, the Trustees authorized filing of an application with the Treasury Department for approval of the Institute as a tax-exempt foundation.

Plans for the construction of the T&RI Training Center had been presented to the Trustees a year ago, and first announced in the January 1957 issue of MODERN CASTINGS. However, the Trustees requested that decision to proceed be deferred until the industry's reception to the new training-course program had been determined.

The proposed T&RI building plan is intended to provide a wide range of laboratories and laboratory equipment to serve a dual purpose. They will provide facilities for practical training and as a supplement to lecture courses, and also will be available to AFS technical committees for "do-it-yourself" phases of AFS-sponsored research projects.

Strong support for the T&RI program is reflected in the response to the initial training courses offered in 1957. All six courses presented were filled to capacity or over-subscribed, with the exception of the first course in July.

The industrial engineering course was repeated and the cupola melting course was presented for a second time in January, 1958 and will be offered again during 1958 in cooperation with two AFS chapters.

Cupola melting of iron course held in Chicago during December completed the activities for 1957. Program for 1958 will be greatly expanded and will include assistance to chapters.

Trustees and staff of the AFS Training & Research Institute, Dec. 11, 1957, Hotel Sherman, Chicago. Seated left to right are: Harry W. Dietert, AFS President; Hyman Bornstein, Chairman; Frank W. Shipley; Dr. G. H. Clamer; and I. R. Wagner. Standing are: Ashley B. Sinnett, AFS Assistant Secretary; Wm. W. Maloney, AFS General Manager and T&RI Secretary-Treasurer; S. C. Massari, AFS Technical Director and T&RI Director; and Ralph E. Betterley, T&RI Training Supervisor.

Diplomas are awarded to students attending courses presented by Training Institute.

Analysis of Registrants

An analysis of the 403 registrants attending courses during 1957 reveals that attendance was drawn from 23 states, two provinces in Canada, and two states in Mexico.

Some fear had been expressed originally that attendance would be confined largely to the cities and areas in which the courses were presented. However, the participants traveled an average round-trip distance of more than 830 miles. Cities in which the courses were conducted provided only 20 per cent of the class registration. With the inclusion of the immediate suburbs, local representation accounted for less than one-third of the enrollments.

Each of the 1957 courses was held five days. On the final day, participants were evaluated on the basis of their absorption of information presented, and the grading of each individual was sent to his superior. An attractive certificate of attendance is presented each man enrolled.

Industry's Response

The T&RI courses were designed to fulfill a three-fold purpose: To help the foundry industry retain valuable manpower through a plan of progressive in-plant advancement; to provide up-grading opportunities for existing personnel through a series of job-training courses, and to enable

management to realize operating benefits through greater personnel efficiency and improved technology.

Industry's enthusiastic response to the courses is revealed in a study of positions represented at the various classes. More metallurgists attended than any other group. Second and third in numbers were foremen and superintendents. Other positions in the first ten categories were engineers, assistant superintendents, sales engineers, technicians, sand laboratory supervisors, melting supervisors, and industrial engineers.

Questionnaires returned by course participants indicate a desire for other T&RI courses covering a wide range of foundry subjects. The ten subjects requested most frequently, in order of demand, are: Gating & Risering of Non-ferrous Castings, Gating & Risering of Ferrous Castings, Metallurgy, Patternmaking, Statistics for Shop Control (Quality), Coremaking, Foundry Costs, Electric Furnace Practice, Molding Practice, and Operation of a Small Foundry Shop.

The schedule of training courses to be presented in 1958, as announced on these pages, is based largely on the expressed needs of participants. A total of 17 courses is planned for 1958, to be given in the middle west, California and Canada.

Further evidence of the assistance given to the industry is the expansion of T&RI activities to include direct assistance to chapters. The cupola melting course will be presented February 10-12 at San Francisco in cooperation with the Northern California Chapter. The same course will be given March 16-18 at Hamilton, Ontario, in cooperation with the Ontario Chapter.

BOUQUETS

Random comments on those who attended the 1957 T&RI Training Courses. In response to a questionnaire on The $64 Question, "was the time and money spent at the course worthwhile to you and your company," 105 said "Decidedly Yes . . . 3 said "Probably not." (*Ed.—That's what makes life interesting!*). All but 5 expressed the opinion that AFS would do well to provide permanent facilities for laboratory-type training courses . . . e.g., the proposed Foundry Training Center building. Where should such facilities be located? Answers: Middle West 93, East 26, Anywhere 18, Canada 6, Far West 1.

1958 Training Courses • ANNOUNCING

Sponsored by AFS Training and Research Institute

Course No.	Subject and Description	Dates	Course Length (Days)	Where Given	Course Fee
M3B-58	**Cupola Melting of Iron** ..... Lecture course for cupola operators, supervisors, metallurgists, foremen. Basic principles for optimum cupola operation are considered. Raw materials, cupola design, quality control, combustion control, metallurgy of cast iron, safety, preventive maintenance and new developments.	Feb. 10-12	3	Berkeley, Calif.	$ 40
T2A-58	**Non-Destructive Testing** ..... Lecture and demonstration course for metallurgists, supervisors, industrial engineers, foremen, castings purchasers and quality control personnel. Standard methods of testing cast metals, application and interpretation. Magnetic particle, X-ray, Gamma-ray, penetrants, fluorescent dyes, new developments and safe practices. Limited to 25.	March 3-7	5	Chicago	$100
M3C-58	**Cupola Melting of Iron** ..... (Concentrated course described under Course M3B)	March 16-18	2	Hamilton, Ont.	$30
M2A-58	**Melting of Copper-Base Alloys** ..... Lecture course for melters, supervisors, metallurgists and foremen. Nomenclature, alloy classification, melting technology, equipment, quality control, testing, and raw materials. Basic control variables are considered in light of optimum results with maximum safety to personnel and equipment.	April 2-4	3	Chicago	$ 40
MTY1A-58	**Metallography of Ferrous Metals** ..... Lecture course for melters, supervisors, foremen, foundry engineers, researchers, laboratory technicians, metallurgists, and design engineers. History, basic metallurgy, terminology, equilibrium and phase diagrams, micro and macro analysis, physical properties based on metallographic interpretation, heat treatment, graphic representation. Equipment and basic principles of metallography.	April 16-18	3	Chicago	$ 40
S1A-58	**Sand Testing** ..... Demonstration and laboratory course. Basic testing methods and equipment are demonstrated in view of sand properties, variables and controls. Desirable course for sand technicians, foremen, supervisors, trainees, and sand suppliers. Limited to 25.	June 2-6	5	Detroit	$125
MTY2A-58	**Metallography of Non-Ferrous Metals** .... Lecture course same as Course No. MTY1, except technology and principles apply to non-ferrous metals.	June 25-27	3	Chicago	$ 40
M3D-58	**Cupola Melting of Iron** ..... (Expanded Course as described under Course M3B)	July 7-11	5	Chicago	$ 65
S23A-58	**Sand Control Technology** ..... Lecture course for foundrymen having had some experience in sand testing, control and technology. Statistical controls, mold wall movement, hot deformation, creep deformation, mold atmosphere, heat transfer, mechanical sand properties, metal penetration and quality control. Pre-requisite Course No. S1 or equivalent experience.	Aug. 4-8	5	Detroit	$ 65

REGISTRATIONS NOW OPEN. Make reservations for all 1958 Training Courses by Course Numbers and dates given. Registrations accepted in order as received to attendance limits shown.

ANNOUNCING

• 1958 Training Courses

Sponsored by AFS Training and Research Institute

Course No.	Subject and Description	Dates	Course Length (Days)	Where Given	Course Fee
PM1A-58	**Patternmaking**	Aug. 18-20	5	Chicago	$ 40
	Lecture and demonstration. Course for patternmakers, foremen supervisors, trainees, purchasers of castings, suppliers, and management. Materials, equipment, layout, allowances, construction techniques, and recent trends. Emphasis placed on new materials, processes, techniques and their application. Limited to 25.				
SAF1A-58	**Industrial Environment**	Sept. 8-12	5	Chicago	$ 65
	Demonstration & lecture course on in-plant environmental problems and safety. Workmen's compensation, first aid, personnel protective equipment, physical examinations, occupational diseases, ventilation, radiation hazards, foundry noise are items included in the study. Appropriate for foremen, supervisors, engineers, safety men and top management.				
PD1A-58	**Product Development**	Sept. 24-26	3	Chicago	$ 40
	Lecture course on product analysis from the design to the marketing of the finished casting. Study will be made of casting design, patterns employed, equipment, cleaning of castings, cost analysis, casting processes, engineering properties of cast metals, and sales promotion. Scheduled for all types of foundry engineers, sales engineers, technicians, supervisors, metallurgists and management.				
SAF2A-58	**Air Pollution Control and Legislation**	Oct. 1-3	3	Chicago	$ 40
	Lecture course covering the laws & interpretation, problems, suggested solutions, and the drafting of intelligent ordinances from the foundrymen's standpoint. Foundry effluents, air cleaning equipment, sampling techniques, all are topics studied. Important course for all supervisory and management personnel.				
IE1A-58	**Industrial Engineering**	Oct. 13-17	5	Chicago	$125
	Lecture and work shop course on better standards and cost control. Rating and motion and time study techniques. Statistical & quality control methods applied to sampling procedures and standards development. Industrial engineers, cost control, time study engineers, supervisors, superintendents and top management. Limited to 25.				
GR1A-58	**Gating and Risering of Ferrous Castings**	Oct. 27-31	5	Chicago	$ 65
	Lecture course on the various problems relating to gating and risering. Metal flow, solidification phenomena, heat transfer, shrinkage, hot tears, ferro-static pressure, gate and riser design, mold wall movement, and surface tension are some of the many facets considered. Intended for foremen, technicians, foundry engineers, supervisors, industrial engineers, and production and quality control personnel.				
IE2A-58	**Foundry Plant Layout**	Nov. 10-12	3	Chicago	$ 40
	Lecture course on problems of rehabilitation or building of new plants. Materials handling, equipment, shop routing, storage, cleaning and shipment, safety & hygiene, production and job shop considerations, all are included. Foremen, Supervisors, industrial and production engineers and management.				

Payment of Tuition Fees should accompany enrollment application. Make all reservations ONLY with Director, AFS Training & Research Institute, Golf & Wolf Roads, Des Plaines, Ill. Tel. VAnderbilt 4-0181.

Other Comments:

"I think it's one of the best courses I've ever taken. I can't see how any company wouldn't gain by having its employees attend the school. It sure was worthwhile!"

"I feel that I have gained considerable knowledge from this course and will be able to help the company and myself."

"Was the time and money spent worthwhile to you and your company? . . . Very emphatically YES.

"Everyone was eager to get as much as possible out of the course and take back valuable information to their companies."

"All phases of the course were very well covered by good, competent instructors."

"All of the instructors were very well versed in practically all phases of foundry operations and collectively have the wealth of experience needed for such a course."

"It was worthwhile and well spent. It only remains to follow through with complete sand control to prove itself."

"The grouping of five students is excellent! While allowing 'personalized' instruction it promoted limited discussion."

"We are grateful to you for your time and effort and commend you on a job well done."

"I felt the course will help me very much in my sales approach to the foundrymen."

"Was the time and money spent worthwhile? If not, it would *not* be the fault of the Training Institute."

"Preparations for this type of session were very well planned and executed. Accommodations and meals were excellent, as was the over-all program. Instructor was very well qualified in his field."

"Realized much from discussion and valued contacts made with men with common interests."

"I have only worked with sand for about a year. In my case the course was extremely worthwhile to me and I believe to my company. I must confess that question and answer sessions are equally effective as lectures in themselves."

"Think I got a great deal from it. It impressed me that all of the meetings started exactly on time and ended on time."

AFS Foundry Show

Continued from page 71

Eastman Kodak Co., Rochester, N. Y.
Electric Controller & Mfg. Co., Cleveland
Electro Metallurgical Co., Div. Union Carbide Corp., New York
Electro Refractories & Abrasives Corp., Buffalo, N. Y.
Encyclopedia Britannica, Detroit
Eutectic Welding Alloys Corp., Flushing, N. Y.
Exomet, Inc., Conneaut, Ohio
Fanner Mfg. Co., Cleveland
Federal Foundry Supply Co., Cleveland
Federated Metals Div., American Smelting & Refining Co., New York
Foundry, Cleveland
Foundry Educational Foundation, Cleveland
Foundry Equipment Co., Cleveland
Foundry Equipment, Ltd., Bedfordshire, England
Foundry Equipment Manufacturer's Association, Washington, D.C.
Foundry Flask & Equipment Co., Northville, Mich.
Foundry Services, Columbus, Ohio
Fox Grinders Inc., Pittsburgh, Pa.
Foxboro Co., Foxboro, Mass.
Freeman Supply Co., Toledo, Ohio
Fremont Flask Co., Fremont, Ohio
Furane Plastics, Inc., Los Angeles
Galland-Henning Mfg. Co., Milwaukee
General Electric Co., Chemical Materials Dept., Pittsfield, Mass.
General Refractories Co., Philadelphia
Girdler Co., Thermex Div., Louisville, Ky.
Daniel Goff Co., Mauricetown, N. J.
Gray Iron Founders Society, Cleveland
Great Lakes Carbon Corp., New York
Great Lakes Foundry Sand Co., Detroit
A. P. Green Fire Brick Co., Mexico, Mo.
Samuel Greenfield, Inc., Buffalo, N. Y.
Guardite Co., Wheeling, Ill.
Harbison—Walker Refractories Co., Pittsburgh, Pa.
Hardy Sand Co., Evansville, Ind.
Benj. Harris & Co., Chicago Heights, Ill.
Hartley Controls Corp., Neenah, Wis.
Haynes Stellite Co., Div. Union Carbide Corp., Kokomo, Ind.
Herman Pneumatic Machine Co., Pittsburgh, Pa.
Hewitt—Robins, Inc., Stamford, Conn.
Hickman, Williams & Co., New York
Hill & Griffith Co., Cincinnati
Hines Flask Co., Cleveland
Hooker Electrochemical Co., N. Tonawanda, N. Y.
Frank G. Hough Co., Libertyville, Ill.
Houghton Laboratories, Olean, N. Y.
Hydro-Blast Div., Guardite Co., Wheeling, Ill.
Illinois Clay Products Co., Chicago
Illinois Testing Laboratories, Inc., Chicago
Inductotherm Corp., Delanco, N. J.
Industrial Electronics Dept., Westinghouse Electric Corp., Baltimore, Md.
Industrial Silica Corp., Youngstown, Ohio
International Foundry Supply Co., Reading, Pa.
International Graphite & Electrode Div., Speer Carbon Co., St. Marys, Pa.
International Minerals & Chemical Corp., Chicago
International Molding Machine Co., LaGrange Park, Ill.
International Nickel Co., New York
Interstate Smelting & Refining Co., Chicago
Iron Lung Ventilator Co., Cleveland
Ironton Fire Brick Co., Ironton, Ohio
Jeffrey Mfg. Co., Columbus, Ohio
Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif.
Kindt—Collins Co., Cleveland
King Tester Corp., Philadelphia
Lester B. Knight & Associates, Chicago
H. Kramer & Co., Chicago
Kuhlman Electric Co., Bay City, Mich.
Laboratory Equipment Corp., St. Joseph, Mich.
Latrobe Steel Co., Latrobe, Ky.
Lava Crucible Refractories Co., Pittsburgh, Pa.
R. Lavin & Sons, Inc., Chicago
Lectromelt Furnace Div., McGraw Edison Co., Pittsburgh, Pa.
Lindberg Engineering Co., Chicago
Linde Air Products Co., Div. of Union Carbide Corp., New York
Link—Belt Co., Chicago
Liquid Carbonic Co., Chicago
Lowery Brothers, Chicago
Magnaflux Corp., Chicago
Magnet Cove Barium Corp., Des Plaines, Ill.
Manley Bros., Chesterton, Ind.
Manley Sand Co., Rockton, Ill.
Martin Engineering Co., Neponset, Ill.
Master Pneumatic Tool Co., Bedford, Ohio
J. S. McCormick Co., Pittsburgh, Pa.
McGraw Edison Co., Pittsburgh, Pa.
Metallizing Co. of America, Chicago
Mexico Refractories Co., Mexico, Mo.
Mine Safety Appliances Co., Pittsburgh, Pa.
Modern Equipment Co., Port Washington, Wis.
Monsanto Chemical Co., St. Louis
Moulders' Friend, Dallas City, Ill.
Nassau Smelting & Refining Co., Staten Island, N. Y.
National Carbon Co., Div. of Union Carbide Corp., New York
National Crucible Co., Philadelphia
National Cylinder Gas Co., Chicago
National Dust Collector Corp., Chicago
National Engineering Co., Chicago
National Lead Co., Chicago
National Metal Abrasive Co., Cleveland
National Safety Council, Chicago
New Jersey Silica Sand Co., Millville, N. J.
Newaygo Engineering Co., Newaygo, Mich.
Niagara Falls Smelting & Refining Div., Continental Copper & Steel Ind., Buffalo, N. Y.
Nichols Engineering & Research Corp., New York
Wm. H. Nichols Co., Richmond Hill, N. Y.
Nolan Machinery Co., U. S. Forge & Foundry, Pulaski, N. Y.
Non-Ferrous Founders' Society, Evanston, Ill.
North American Smelting Co., Wilmington, Del.
North State Pyrophyllite Co., Greensboro, N. C.
S. Obermayer Co., Chicago
Ohio Crankshaft Co., Tocco Div., Cleveland
Ohio Ferro—Alloys Corp., Canton, Ohio
Oliver Machinery Co., Grand Rapids, Mich.
Orefraction, Inc., Pittsburgh, Pa.
Osborn Mfg. Co., Cleveland
Pangborn Corp., Hagerstown, Md.
Pekay Machine & Engineering Co., Chicago
Penn—Rillton Co., New York
Penola Oil Co., Detroit
Pettibone Mulliken Corp., Chicago
George F. Pettinos, Philadelphia
Picker X-Ray Corp., White Plains, N. Y.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Planet Corp., Lansing, Mich.
Pure Carbonic Co., New York
Pyrometer Instrument Co., Bergenfield, N. J.
Redford Iron & Equipment Co., Detroit
Rezolin, Inc., Santa Monica, Calif.
Roessing Bronze Co., Pittsburgh, Pa.
Ross—Tacony Crucible Co., Philadelphia
Rotor Tool Co., Cleveland
Royer Foundry & Machine Co., Kingston, Pa.
Sand Products Corp., Cleveland
Claude B. Schneible Co., Detroit
A. Schrader's Sons Div., Scovill Mfg. Co., Brooklyn, N. Y.
Schramm, Inc., West Chester, Pa.
I. Schumann & Co., Cleveland
Scientific Cast Products Corp., Cleveland
Scovill Mfg. Co., Brooklyn, N. Y.
Semet Solvay Co., Div., Allied Chemical & Dye Corp., New York
Shalco Corp., Palo Alto, Calif.
Shell Equipment Co., Connellsville, Pa.
Shell Process, Inc., North Springfield, Mass.
Simplicity Engineering Co., Durand, Mich.
Sipi Metals Corp., Chicago
A. O. Smith Corp., Milwaukee
G. E. Smith, Inc., Pittsburgh, Pa.
Smith & Richardson Mfg. Co., Geneva, Ill.
Speer Carbon Co., St. Marys, Pa.
Spencer Turbine Co., Hartford, Conn.
SPO Incorporated, Cleveland
Square—D Co., Cleveland
Standard Electrical Tool Co., Cincinnati
Standard Horse Nail Co., New Brighton, Pa.
Sterling Wheelbarrow Co., Milwaukee
Frederic B. Stevens Inc., Detroit
Stroman Furnace & Engineering Co., Franklin Park, Ill.
Sutter Products Co., Dearborn, Mich.
Tabor Mfg. Co., Philadelphia
Taggart Brimfield Co., Hammonton, N.J.
G. H. Tennant Co., Minneapolis
Thermex Div., Girdler Co., Louisville, Ky.
Tocco Div., Ohio Crankshaft Co., Cleveland
Union Carbide Corp., New York
United Oil Mfg. Co., Erie, Pa.
United States Electrical Tool Co., Cincinnati
United States Forge & Foundry, Pulaski, N. Y.
United States Gypsum Co., Chicago
U. S. Reduction Co., East Chicago, Ind.
United States Rubber Co., New York
Vacu—Blast Co., Belmont, Calif.
Vanadium Corp. of America, New York
Vesuvius Crucible Co., Pittsburgh, Pa.
Westover Corp., Milwaukee
Westinghouse Electric Corp., Industrial Electronics Dept., Baltimore, Md.
Wheelabrator Corp., Mishawaka, Ind.
Whirl—Air—Flow Corp., Chicago
White Pine Lumber Co., Chicago
Whitehead Bros., New York
Whiting Corp., Harvey, Ill.
Wolverine Foundry Supply Co., Detroit
Yale & Towne Mfg. Co., Philadelphia

International Foundry Congress will be Held in Belgium Sept. 29-Oct. 3

■ Programming is rapidly developing for the 1958 International Foundry Congress to be held in Belgium, Sept. 29-Oct. 3. An AFS Official Exchange Paper as well as several other papers by United States foundrymen will be presented at the 25th International Congress to be held in Brussels and Liege.

Word has been received that hotel space is limited. Each member association of the International Committee of Foundry Technical Associations has been asked to endorse all applications for housing accommodations.

The American Foundrymen's Society is the only United States member of the International Committee.

The International Foundry Congress is sponsored by the International Committee which includes foundry associations of the following countries:

Famous Grand Plaza of Brussels with Grand Palace and guild houses (rear).

View of foundry and heavy industrial section of **Liege**. Belgium, essentially a manufacturing country, has an abundance of coal and exports 70 per cent of its steel.

Austria; Australia; Belgium; Czechoslovakia; Denmark; Finland; France; Germany; Great Britain; India; Italy; Japan; Netherlands; Norway; Poland; Spain; Sweden; Switzerland; United States; and Yugoslavia.

The Association Technique de Fonderie de Belgique will act as host to the 1958 International Foundry Congress.

Wisconsin Chapter's 21st Regional Conference to be Held Feb. 13-14

Two full days of technical sessions will be presented at the 21st Wisconsin Regional Foundry Conference to be held Feb. 13-14 at the Hotel Schroeder, Milwaukee. The annual conference is sponsored by the AFS Wisconsin Chapter in cooperation with the University of Wisconsin.

Simultaneous sectional meetings will be held daily to present the 20 technical papers dealing with a wide range of foundry subjects.

Papers have been divided into five categories: malleable, non-ferrous, gray iron, steel, and pattern.

The conference committee is headed by Chairman Leslie J. Woehlke, Grede Foundries, Inc., Milwaukee. L. S. Krueger, Pelton Steel Casting Co., Milwaukee, and Professor P. C. Rosenthal, University of Wisconsin, Madison, Wis. are conference co-chairmen.

Leslie J. Woehlke

THURSDAY, Feb. 13

9:00 am Registration.

10:00 am *"Planning for the Future,"* Kurt F. Wendt, Dean, College of Engineering, University of Wisconsin, Madison, Wis.
"The Man We Employ," AFS President Harry W. Dietert, H. W. Dietert Co., Detroit.
"Horizons Unlimited," Allen M. Slichter, Pelton Steel Casting Co., Milwaukee.

10:50 am *"Safety Aspects of New Foundry Processes,"* Dr. Edward G. Meiter, Employers Mutual Liability Insurance Co.

12:00 noon *"Political Business,"* Carl Taylor, President, Waukesha State Bank, Waukesha, Wis.

Sectional Meetings

2:15-3:45 pm

Malleable—*"Cost Control in the Foundry,"* R. K. Daily, Lester B. Knight & Associates, Inc., Chicago.

Non-Ferrous—*"Good Aluminum Foundry Practice,"* A. Nichamin, Federated Metals Div., American Smelting & Refining Co., Detroit.

Gray Iron—*"Water-Cooled Cupola Construction, Economics, Operations, and Problems,"* Mervin H. Horton, John Deere & Co., Moline, Ill.

Steel—*"Deoxidation of Steel Castings,"* Clarence Sims, Battelle Memorial Institute, Columbus, Ohio.

Pattern—*"Advanced Plastics,"* Robert LeMaster, R. A. Nelson Pattern Co., Milwaukee.

Sectional Meetings

4:00-5:30 pm

Malleable—*"CO_2 Core Making and Molding Gassing of Sodium Silicate Cores,"* V. A. Guebard, Jr., International Harvester Co., Milwaukee.

Non-Ferrous—*"Cost Problems in the Cleaning Room,"* Oscar Kraft, Westover Engineering, Inc., Milwaukee.

Gray Iron—*"Molding — Nothing Has Changed,"* Alexander D. Barczak, Superior Foundry Inc., Cleveland.

Steel—*"Solidification of Cast Steels and Practical Application of Exothermic Materials,"* George Witt, Foundry Services, Lombard, Ill.

Pattern—*"Pattern Engineering,"* George Schuller, Caterpillar Tractor Co., Peoria, Ill.

6:30 pm Banquet *"Wisconsin Faces the Challenge of the Future,"* Vernon W. Thomson, Governor of Wisconsin.

FRIDAY, Feb. 14

Sectional Meetings

10:00-11:50 am

Malleable—*"Foundry Maintenance,"* Fred Gunther, Belle City Malleable Co., Racine, Wis.

Non-Ferrous—*"How the Melting of Brasses and Bronzes Affects the Quality of Castings,"* William M. Ball, Jr., R. Lavin & Sons, Inc., Chicago.

Gray Iron—*"Noise and its Possible Effects in the Foundry,"* Dr. William L. Lea, Wisconsin State Board of Health.

Steel—*"How Do You Handle Your Arc-Air Operations,"* Lloyd Olson, Bucyrus-Erie Co., South Milwaukee, Wis.; Steve Kline, Crucible Steel Casting Co., Milwaukee; Arthur Hare, Grede Foundries, Inc., Milwaukee.

Pattern—*"Pattern Equipment for CO_2 Process,"* James Venetucci, Liquid Carbonic Corp., Chicago.

12:00 Noon Luncheon, *"How Other People Talk,"* George Gilbert Groman.

Sectional Meetings

2:30-4:00 pm

Malleable — *"Safety and Industrial Health,"* Walter Scholtz, Allis-Chalmers Mfg. Co., Milwaukee.

Non-Ferrous—*"Core Making & Core Blowing,"* Z. Madacey, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago.

Gray Iron—*"Gating of Gray Iron Castings,"* John F. Wallace, Case Institute of Technology, Cleveland.

Steel—*"Hot Tears—A Major Casting Defect,"* Charles Christopher, Blaw-Knox Co., Munster, Ind.

Pattern—*"Apprentice Program Forum,"* Gilbert Wilms, Caterpillar Tractor Co., Milwaukee; Erwin Czwinski, R. A. Nelson Pattern Co., Milwaukee; August Komar, Spring City Pattern Co., Waukesha, Wis.; Leonard Licau, Allis-Chalmers Mfg. Co., Milwaukee; George Schroeder, Fond du Lac Pattern Co., Fond du Lac, Wis.; Carl Jurack, Charles Jurack Pattern Co., Milwaukee.

Southeastern Regional Conference Will Cover Methods of Improving Production

Keys to more efficient operations ranging from gating design to an outline on successful foundry operations will be presented at the annual Southeastern Regional Foundry Conference. The conference will be held at the Patten Hotel, Chattanooga, Tenn., Feb. 20-21 sponsored by the Tennessee Chapter, Birmingham District Chapter, and University of Alabama Student Chapter of the American Foundrymen's Society.

Technical sessions will be supplemented by plant tours, luncheons, a dinner, and an annual banquet.

G. Frank Anderson, Tennessee Products & Chemical Corp., Chattanooga, Tenn., and Chairman of the Tennessee Chapter will be the conference general chairman. He will be assisted by Sam F. Carter, Jr., American Cast Iron Pipe Co., Birmingham, Ala., Chairman of the Birmingham District Chapter.

The program:

THURSDAY, FEB. 20

9:00 am Registration.

9:50 am Opening of Conference.

10:00 am *"Future of the Foundry Industry,"* F. G. Steinebach, Penton Publishing Co., Cleveland.

11:00 am *"Legislation Affecting Foundries,"* H. J. Weber, AFS Director of Safety, Hygiene, and Air Pollution Control.

12:30 pm Ladies Luncheon, Fairyland Club.
Men's Luncheon, Patten Hotel. W. L. Austin, U. S. Pipe & Foundry Co., Chattanooga, Tenn. presiding. Speakers: AFS President Harry W. Dietert; AFS Vice-President L. H. Durdin.

2:00 pm *"Water-Cooled Cupola Operation,"* M. J. Henley, Tyler Pipe & Foundry Co., Tyler, Texas.

3:00 pm *"Green Sand Molding,"* T. E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Co., Chicago.

4:00 pm *"Effect of Gating Practice,"* J. G. Kura, Battelle Memorial Institute, Columbus, Ohio.

6:00 pm Reception, Read House.
7:00 pm Dinner, Read House.

FRIDAY, FEB. 21

9:00 am Plant visitations.
1:30 pm *"Fundamentals of a Successful Foundry Operation,"* Henry Marius, Lenoir Car Works, Lenoir City, Tenn.
"Major Aluminum Problems and Their Solution," D. L. LaVelle, Federal Metals Div., American Smelting & Refining Co., South Plainfield, N. J.
2:30 pm *"Use of Plastics in the Pattern Shop,"* W. R. Weaver, Modern Pattern & Plastics, Inc., Toledo, Ohio.
"Bentonite in Synthetic Molding Sand," V. E. Zang, Unitcast Corp., Toledo, Ohio.
3:30 pm *"CO_2 Process and Coremaking,"* Leroy A. Bizzell, U. S. Pipe & Foundry Co., Chattanooga, Tenn.
7:00 pm Annual Banquet, G. Frank Anderson presiding. *"Automation and You,"* Leo Aikman, Atlanta, Ga.

Use Advance Registration Form for Avoiding Delays

■ Foundrymen and guests attending the 62d AFS Castings Congress & Foundry Show to be held at Cleveland May 19-23, may obtain their badges in advance by filling out advance registration cards found in this issue of MODERN CASTINGS, pp 99-100.

Both cards must be filled out completely and returned with the proper remittance, $2 for members and $5 for non-members, to AFS Headquarters, Des Plaines, Ill., prior to May 5.

Those obtaining badges ahead of time will eliminate delays encountered in registering at Cleveland. Badges are required for admittance to exhibits and all technical sessions.

AFS Committees in Action

Radiation Protection Committee

■ An outline of the RADIATION PROTECTION MANUAL was revised and set up in chapter form at a November meeting held in Chicago. Specific topics were assigned to committeemen for preparation. The manual was divided into nine chapters.

Floyd S. Sutherland, Continental Foundry & Machine Div., Blaw-Knox Co., East Chicago, Ind., was appointed as Committee Vice-Chairman.

Sand Division

■ Discussion at the December meeting of the Controlled Casting Quality Committee centered around revising the CASTINGS DEFECT HANDBOOK. The revision is the responsibility of the committee. The project will be extended to include all cast metals and defects common to all branches of the casting industry.

The format will consist of a tabular outline of causes of defects, definition of individual causes, outline of causes, and narrative coverage of remedial measures.

Committee members were given the following assignments:

■ Design, Pattern Equipment, Flask Equipment and Rigging—J. W. Costello.
■ Gating and Risering—G. W. Anselman and R. G. Wiese.
■ Sand—E. H. Phelps and T. V. Alford.
■ Cores—Victor Rowell.
■ Molding Practice—E. H. Phelps and T. C. Alford.
■ Metal Composition, Melting Practice, and Pouring—T. E. Barlow and W. K. Gibb.
■ Miscellaneous—G. W. Anselman.

Detroit Chapter held its Ladies' Night in November with 100 couples attending. The program included a dinner, dancing, and games. Photo shows Harry Gravlin, Chrysler Corp., auctioning off prizes.—*Jess Toth*

Chapter News

Ontario Chapter Studies Cost Control Honors Four 50-year Foundrymen

■ Cost control in foundries was discussed at the December meeting featuring a three-man panel. Technical Chairman J. M. Hughes, Stevenson & Kellogg, Ltd., Toronto, Ont., acted as moderator.

The panel consisted of Ted Tafel, Jr., American Standard Products (Canada) Ltd., Toronto, Ont.; J. P. Lubenkov, Link-Belt Ltd., Elmira, Ont.; and M. Johnston, Neptune Meters, Ltd., Toronto, Ont.

Tafel spoke of the budget and control system used at American Standard and outlined reasons why line supervision should participate in such cost controls.

Johnston pointed out that cost controls at Neptune Meters were achieved through use of work sheets. These sheets breakdown each job into man-hours and the effect each function of production has on the final cost. The charts allow quick spotting of operations which should be brought under control.

Lubenkov illustrated how cost controls are used to improve estimating procedures. Estimating was previously done on a pound basis with little or no attention paid to the complexity of the job.

Estimates are now made on the basis of individual pieces with records kept on cost-overhead, both direct and indirect, for all labor and materials.

Four, 50-year foundrymen were honored at the December meeting. Each was presented with a pin by Bob Robertson, International Harvester Co. of Canada, Ltd., Hamilton, Ont. Those honored were:

Clarence Dorson, 66 years old, who entered the foundry industry in 1907. He is now on retirement from National Iron Div., Canada Iron Foundries, Ltd.

Model of foundry used by Link-Belt Ltd., to analyze problems is studied by C. Woodall, J. P. Lubenkov, and Jack Woodall. Lubenkov addressed the **Ontario Chapter** in December on cost controls.

Walter Price, 70 years old, started in the foundry industry in 1902. Now a melt foreman with Welland Iron & Brass, Welland, Ont.

George Stewart, 65 years old, who began his employment with Canadian Westinghouse Co., Ltd., Hamilton, Ont., in 1907 and is now pattern-shop foreman.

Jerry J. Dillion who has been with Galt Malleable, Galt, Ontario, for 51 years and is now plant superintendent.—*P. J. Provias*

Ted Tafel, Jr., American Standard Products (Canada) Ltd., far left, shown with line supervisors during a discussion on foundry cost control. Left to right, Jack Briggs, Reg Gale, Ted Skelly, Ted Simmons, Carmen Monico, Tom Wakaruk, Kash Szmelter, Leo Baumgard, Tom Hawkins, and James McCabe. Tafel was a participant in the **Ontario** December meeting dealing with cost controls.

Michiana Chapter

National Officers Attend

AFS President Harry W. Dietert and AFS Director Gerald R. Rusk attended the December meeting. President Dietert summarized the activities of the Society and Director Rusk discussed the Michiana Chapter.

William Oakley, Delhi Sand Co., Cincinnati, was the technical speaker discussing the CO_2 process. He covered cost and application, types of sands to use, necessary additives, and proper mixing cycles. Advantages were listed as ability to hold closer tolerances, less scabbing and rat-tails, and elimination of core ovens. Disadvantages were also covered including poor collapsibility, difficulty of stripping with deep draws, and the tendency for sand to dry excessively.

Attending the December meeting of the **Michiana Chapter** were Chapter Chairman James C. Maggart, AFS President H. W. Dietert, AFS Director G. R. Rusk and Chapter Director W. Vern Compton.

Texas Chapter

Be a Worker, Not a Drone, A Few Can't Do It All Alone

The following poem was included in a letter to members of the Texas Chapter sent by E. C. Brown, Chapter Chairman. The author is unknown. The poem was taken from the Houston Plumbing & Heating News with changes made to fit the foundry industry.

BE AN ACTIVE MEMBER

Be an active member,
The kind that would be missed;
Don't be just contented
That your name is on the list.

Do attend the meetings
And mingle with the crowd;
Don't stay at the foundry
And crab both long and loud.

Do take an active part
To make A.F.S. work slick;
Take time out to visit
A member who is sick.
Don't leave the work for just a few
And gripe about the clique.

There is a program scheduled
That means success *if done*,
And it can be accomplished
When "Service above Self" *is done.*

Central Indiana Chapter monthly features displays of products produced by foundries in the chapter area. Shown on right are piston rings. On the left are automotive die castings.—*William R. Patrick*

Approximately 140 foundrymen and guests attended the December meeting of the **St. Louis Chapter.** A musical group performed during the dinner. E. H. King, Hill & Griffith Co., Cincinnati, was the featured speaker, discussing *"Molding Sands and Molding Methods."* Among the topics covered were mold coating; natural and synthetic sands; and permeability, moisture and green strength. Shown in photo are: Chapter Chairman James A. Cannon, speaker King, and Raymond E. Miller, technical chairman.

More than 200 foundrymen and guests attended the **Central New York Chapter's** 17th annual Christmas party held at the Onondaga Hotel, Syracuse, N.Y. Entertainment was provided following a dinner. Donald C. Brainard, Dayton Oil Co., Dayton, Ohio, was chairman of the entertainment committee. Picture shows Chapter Treasurer Robert P. Watson selling a ticket to Joseph Coin.—*Carl Diehl*

New England's First Ladies' Night attended by 300 persons

Mrs. Henry Stenberg, wife of AFS Director, H. G. Stenberg, Draper Corp., Hopedale, Mass., receives a door prize.

Mrs. Harry Sleicher, Seaboard Foundry, Inc., Providence, R.I., receiving a door prize from Will Naughton, Whitehead Bros. Co., and Alexander Beck, Whitman Foundry, Inc., Whitman, Mass., chapter president.

Mr. and Mrs. Percy Skewes, Mr. and Mrs. Tom Brigham, Mr. and Mrs. Mel Illsley, Concord Foundries, Div., Scott & Williams, Inc., Concord, Mass., and Mrs. John Orrok, Debevoise-Anderson Co., Boston.

Mr. & Mrs. A. W. Sorensen and Mr. and Mrs. Frank Ward of Wollaston Foundry, Corp., North Quincy, Mass.

Western New York

Air Pollution

■ A committee was appointed at the December meeting to represent foundry interests at all public discussions of air pollution legislation in the Buffalo area. H. J. Weber, AFS Director of Safety, Hygiene, and Air Pollution Control, addressed the chapter on *"New Laws Recently Enacted As Regards to Air Pollution."* The annual smorgasbord dinner was attended by 125 foundrymen.—*Walter Napp*

H. J. Weber addressing chapter on recent air pollution laws affecting foundries.

G. F. Goetsch, Sterling Wheelbarrow Co., Buffalo, N.Y., sells a dinner ticket to Ronald Turner, Queen City Sand & Supply Co., N.Y.

Father and son attending the November **Western New York** meeting were H. A. Mason, Jr. and H. A. Mason, Sr.

Chicago Chapter

Presents Five Speakers

■ Five speakers addressed the Chapter at its December meeting. AFS President Harry W. Dietert outlined the progress the foundry industry is making in advancement of education and also stated that AFS is making more technical publications available to foundrymen.

In discussing the AFS 62d Castings Congress & Foundry Show, President Dietert pointed out that the large number of exhibitors indicates the advances being made through the development of new equipment and techniques.

Jack E. Bolt, General Electric Co., Pittsfield, Mass., presented *"Shell Molding Materials and Equipment."* He covered the progress in shell molding over the last 15 years, tracing the development of both equipment and materials.

Color slides illustrated the various stages of shell sand during mulling as well as micro views of resin action during curing. In addition, general information was presented on the making of shell molds and cores and the bonding of shell mold sections.

Bolt told of the importance of preventive maintenance in obtaining optimum service from shell molding equipment, stressing the necessity of proper lubrication at the intervals recommended by the manufacturer.

"Gating and Risering for X-Ray and Pressure Quality," was presented by Arnold Grot, Edward Valves, Inc., Div. of Rockwell Mfg. Corp. He showed slides depicting steps to properly design cast steel valves. The importance of properly balanced casting sections to obtain desirable directional solidification, was emphasized. A film of metal flow and action in the cavity of the mold was shown.

Other speakers were Lawrence W. Winnings, Wagner Malleable Iron Co., Decatur, Ill., whose subject was *"Gating and Feeding Malleable Castings,"* and Ed Moir, Howard Foundry Co., Chicago, who spoke on *"Pattern Quality and Maintenance."*

Participating in **Chicago's** December meeting were speakers Lawrence W. Winnings and Arnold Grot, AFS President Harry W. Dietert, Chapter Chairman W. O. McFatridge, and speakers Ed Moir and Jack E. Bolt.

Tennessee Chapter

Sand Fundamentals

■ Sand fundamentals, particularly the problem of sand separation in storage bins and silos, were discussed at the November meeting by Clifford Wenninger, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago.

The speaker illustrated the proper method of storing sand, the best way to place the openings and pipes to draw sand from the bins. He stressed the fact that the receiving bin at the bottom of the silo should be larger in area than the openings dropping sand into the bin. The tendency for sand to segregate when drawn from silos is reflected later in casting defects.—*Fred Hetzler*

Participating in the **Tennessee** November meeting were Speaker Wenninger; Chairman G. Frank Anderson, Tennessee Products & Chemical Corp., Chattanooga, Tenn.; and Vice-Chairman W. L. Austin, U.S. Pipe & Foundry Co., Chattanooga, Tenn.

Attending the November meeting were Howard M. Barker, U.S. Pipe & Foundry Co.; Herman F. Bohr, Robbins & Bohr; Charles E. Seman, Crane Co.; and James J. Payne, Ross-Mehan Foundries.

Pittsburgh Chapter's annual Christmas party was held Dec. 9 with more than 1000 persons attending. The party featured a dinner and entertainment.—*Walter Napp*

Philadelphia Annually Gives Coleman Scholarship Award

■ Financial aid to an outstanding senior student in the foundry course at Pennsylvania State University, State College, Pa., is given annually by the Philadelphia Chapter. This year's award was made to Joseph Dopkin at the October chapter meeting. Three senior students have been recipients of the $500 William B. Coleman Scholarship award, named for the first chairman of the chapter.

Factors considered in awarding the scholarship include past academic achievement, desirable personality and character traits, evidence of leadership, participation in extracurricular activities, past association in the foundry industry, interest in the foundry industry, and financial need.

The Pennsylvania State University Committee on Scholarships and Fellowships of the College of Engineering and Architecture reviews all applicants and chooses four students to be nominated. The chapter's Scholarship Committee then selects the student to receive the award.—*E. C. Klank*

Winner of the **Philadelphia Chapter** William B. Coleman Scholarship award, Joseph Dopkin, center, is flanked by D. E. Best, Bethlehem Steel Co., Bethlehem, Pa., chairman of the Coleman Scholarship Committee, and W. S. Giele, W. S. Giele Co., Lebanon, Pa., former Chapter Chairman and member of the Coleman Scholarship Committee.

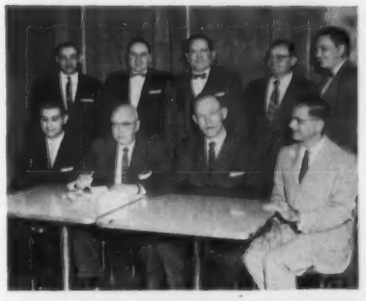
Past chairmen of the Philadelphia Chapter maintain an active interest in chapter affairs. Attending a recent meeting were, left to right: D. E. Best, Bethlehem Steel Co., Bethlehem, Pa.; W. S. Giele, W. S. Giele Co., Lebanon, Pa.; H. C. Winte, Florence Pipe Foundry & Machine Co., Florence, N. J., present chairman; E. C. Troy, E. C. Troy Co., Riverton, N.J.; and J. M. Robb, Philadelphia

Northwestern Pennsylvania

Two December Meetings

■ The second annual Ladies' Night and Christmas party was held Dec. 7 with more than 250 persons attending. Dinner was followed by a floor show and dancing.

Officers and directors met Dec. 16 with Dan J. Hayes, AFS field director, to discuss chapter membership.—*H. L. Buchanan*



Northwestern Pennsylvania Chapter's committee for Ladies' Night and Christmas Party shown at recent meeting. Sitting left to right are: Pete Pascale, U.S. Metal Products Co.; Arthur Ostergard, Diamond Alkali Co.; Chapter Chairman Wilbur Ferguson, Pickands Mather & Co.; and James Pace, United Oil Mfg. Co. Standing are: O. C. Bueg, Arrow Pattern and Engineering Co.; James J. Markowitz, Cascade Foundry Co.; William J. Miller, Frederic B. Stevens Co.; Stanley Walkiewicz, Griswold Mfg. Co.; and Howard Diemert, Erie Bronze Co. The picture was taken by Paul Green, General Electric Co., also a committee member.

Northwestern Pennsylvania Chapter held its annual Ladies' Night Holiday Party and Dance Dec. 7 in Erie, Pa. A dinner, entertainment, door prizes, and dancing were included.—*Walter Napp*

Twin City Chapter

Precision Castings

■ Precision investment castings were discussed at the November meeting, held jointly with the American Society for Metals local chapter.

Frank S. Badger, Jr., Haynes Stellite Co., Div. Union Carbide, Kokomo, Ind., was the evening's speaker. Badger credited the industrial beginning of the lost wax process to the production of turbo supercharger impeller blades in 1941.

Present applications include:

- Use where difficult-to-machine alloys are used
- Use where intricate shapes are desired
- Use where surfaces are highly critical
- Use where several castings are to be combined
- Use where "as cast" tolerances are ±0.005 in.—*J. David Johnson*

Twin City's technical speaker for November was Frank S. Badger, Jr., right, shown with Robert J. Mulligan, Chapter Vice-Chairman.

Central Michigan

Christmas Party

■ A near capacity crowd attended the chapter's annual Christmas party held at the Hart Hotel, Battle Creek, Mich. A social hour preceeded the dinner. AFS President Harry W. Dietert and Mrs. Dietert were guests.—*Richard F. Ell*

Past Chairmen and wives meet with President Dietert. Left to right are Mr. and Mrs. David Boyd, Mr. and Mrs. Gerald Strong, Mr. and Mrs. Robert Dodge, President Dietert, Prof. and Mrs. C. C. Sigerfoos, and Mr. and Mrs. Thomas Lloyd.

Past Chairman's award was given to Gerald Strong, left, by Chairman Robert Dodge.

Mo-Kan Chapter

Christmas Party

■ More than 350 foundrymen and guests attended the 9th annual Christmas party and dinner dance held December 7, at the President Hotel, Kansas City, Mo.—*J. T. Schlanker*

Toledo Chapter's December meeting for the past several years has included visits by AFS National Officers and talks devoted to management. In keeping with tradition AFS President Harry W. Dietert and National Director Gerald Rusk were honored guests. Thirty-two foundries in the Toledo area had management representatives attending the meeting. Shown in photo are chapter chairman M. J. Gruhler, Unitcast Corp., Toledo, Ohio; Frank Steinebach, Penton Publishing Co., Cleveland, who spoke on *"Future in the Foundry Industry;"* Chapter Vice-Chairman Richard Bossert, Maumee Malleable Casting Co., Toledo, Ohio; AFS President Dietert, H. W. Dietert Co., Detroit; and Gerald Rusk, AFS Director, Freeman Supply Co., Toledo, Ohio.—*R. C. Van Hellen*

Eastern New York

Christmas Party

■ Approximately 200 members and guests attended the annual Christmas party held at Panetta's Restaurant, Menands, N. Y. on Dec. 17. A dinner was followed by an evening's entertainment. *Leonard C. Johnson*

Plastics in foundries were discussed at the December meeting of the **Saginaw Valley Chapter.** Andre B. Kerr, Bakelite Co., Div. Union Carbide Corp., New York, spoke on the present and future applications of various plastics. W. R. Weaver, Modern Pattern & Plastics, Inc., Toledo, Ohio, outlined methods of making plastic patterns and their present day applications. Left to right in picture are: AFS Director Charles E. Nelson; Arthur H. Karpicke, Chapter Vice-Chairman; AFS President Harry W. Dietert; Ormond Requadt, Chapter Secretary; and Vernon J. Sadler, Chapter Chairman.—*R. M. Giaffo*

afs chapter meetings

FEBRUARY

Birmingham District . . *See Southeastern Regional Foundry Conference.*

British Columbia . . Feb. 12 . . Vocational Institute, Vancouver, B.C. . . W. M. Armstrong, University of British Columbia, *"Foundry Quality Control," and Visit to Coast Testing Laboratories, Ltd.*

Canton District . . Feb. 6 . . Elks Club, Barberton, Ohio . . G. W. Anselman, Whirl Air Flow Corp. *"Handling Sand by Whirl-Air-Flow."*

Central Illinois . . Feb. 3 . . Vonachen's Junction . . N. Demos, General Electric Co., *"Quality Control."*

Central Indiana . . Feb. 3 . . Athenaeum Turners, Indianapolis . . *Panel*: R. Figg, American Foundry Co.; E. X. Wiley, Atlas Foundry Co.; R. Langsenkamp, Langsenkamp-Wheeler Brass Works; B. J. Lavelle, Lavelle Gray Iron Foundry Corp.; R. D. Millhouse, Marion Malleable Iron Works; J. M. Thomas, Sonith Industries, Inc. *Moderator*: A. J. Reid, General Refractories Co. *"Know Your Area Foundries."*

Central Michigan . . Feb. 19 . . Hart Hotel, Battle Creek, Mich.

Central New York . . Feb. 7 . . Onondaga Hotel, Syracuse, N. Y. . . J. A. Mueller, The Carborundum Co., *"Saving on Snagging & Cut-Off Costs."*

Central Ohio . . Feb. 10 . . Seneca Hotel, Columbus, Ohio . . C. E. McQuiston, Advance Foundry Co., *"Quality Control in the Foundry."*

Chesapeake . . Feb. 28 . . Engineers' Club, Baltimore, Md. . . W. M. Ball, R. Lavin & Sons, Inc., *"Non-Ferrous Foundry Practice."*

Chicago . . Feb. 3 . . Chicago Bar Association, Chicago . . *Non-Ferrous & Gray Iron Group*: C. A. Sanders, American Colloid Co., *"Molding Methods Compared"; Malleable Group*: R. W. Heine, University of Wisconsin, *"Controlling Malleable Iron Scrap"; Steel & Maintenance Group*: F. H. Hohn, Scullin Steel Co., *"Vacuum Melting."*

Cincinnati District . . Feb. 10 . . Elk's Club, Cincinnati . . H. Felten, Peoria Malleable Castings Co., *"Practical Scrap Reduction."*

Connecticut . . Feb. 25 . . **Waverly Inn,** Cheshire, Conn. . . *Education Night. Panel*: W. Wilson, Bullard-Havens Technical School, C. Bengston, Farrel-Birmingham Co., Inc., and T. Yoczik, State Dept. of Labor, *"How Can AFS Connecticut Chapter Best Further Teaching of Foundry Practice in the Area."*

Corn Belt . . Feb. 7 . . Fireside Restaurant, Omaha, Neb. . . F. Newberry, Oklahoma Steel Castings Co., *"Pad Washing."*

Detroit . . Feb. 20 . . Tuller Hotel, Detroit . . *Panel*: T. R. Schroeder, Pontiac Motor Div., GMC; R. W. Gardner, Ford Motor Co.; J. Anderson, Chrysler Corp.; L. H. Kinney, Chrysler Corp. *Moderator*: H. E Gravlin, Chrysler Corp. *"So You Think Your Casting Is Clean!"*

Eastern Canada . . Feb. 21 . . Sheraton-Mt. Royal Hotel, Montreal, Que. . . F. W. Kellam, Electro Metallurgical Co., Div. of Union Carbide (Canada) Ltd., *"Alloying of Iron & Steel."*

Eastern New York . . Feb. 18 . . Panetta's Restaurant, Menands, N. Y.

Metropolitan . . Feb. 3 . . Essex House, Newark, N. J. . . J. A. Gitzen, Delta Oil Products Co., *"Chemical & Physical Properties of Cores & Core Washes."*

Mexico . . *No Information Available.*

Michiana . . Feb. 10 . . Club Normandy, Mishawaka, Ind. . . F. B. Rote, Albion Malleable Iron Co., *"Resin Sand Cores."*

Mid-South . . Feb. 14 . . Claridge Hotel, Memphis, Tenn. . . *Movie, "Mold Making."*

Mo-Kan . . Feb. 7 . . Fairfax Airport, Kansas City, Kans. . . W. B. Bishop, Archer-Daniels-Midland Co. The Federated Foundry Supply Div., *"Which Core Process."*

New England . . Feb. 12 . . University Club, Boston . . *Panel*: F. Tibbets, Wollaston Brass & Aluminum Foundry, Inc., and R. Anderson, Draper Corp., *"Co_2 Core Practice."*

Northeastern Ohio . . Feb. 1 . . Tudor Arms Hotel, Cleveland . . *2d Annual Ladies' Night* . . **Feb. 13** . . J. F. Roth, Cleveland Standard Pattern Works, *"Developments in Pattern Design & New Materials."*

Northern California . . Feb. 17 . . Spenger's, Berkeley, Calif. . . *Panel*: J. L. Francis, Micro Metals, Inc., and H. von Wolff, Shalco Engineering Co., *"Shell Molding & Coremaking."*

Northern Illinois & Southern Wisconsin . . Feb. 11 . . Lafayette Hotel, Rockford, Ill.

Northwestern Pennsylvania . . Feb. 24 . . Amity Inn, Erie, Pa. . . M. J. Kellner, Trafford Foundry Div., Westinghouse

Electric Corp., *"An Approach to More Profitable Operations in the Foundry."*

Ontario . . Feb. 21 . . Royal Connaught Hotel, Hamilton, Ont. . . *Pattern Group*: R. H. Smith, Hysol (Canada) Ltd., *"Plastic Patterns; Welding Group*: H. J. Nicholls, Dept. of Mines & Technical Surveys, *"Welding & Brazing of Castings."*

Oregon . . Feb. 19 . . Heathman Hotel, Portland, Ore. *Apprenticeship Contest.*

Philadelphia . . Feb. 14 . . Engineers' Club, Philadelphia . . *Welding*: S. Walters, Air Reduction Co., Inc.; *Impregnation*: L. Palmer, American Metaseal Corp., *"Rectification of Casting Deficiencies—Standards & Methods."*

Piedmont . . No Meeting.

Pittsburgh . . Feb. 17 . . Hotel Webster Hall, Pittsburgh, Pa. . . F. L. Riddell, H. Kramer & Co., *"Control of Quality of Copper Base Alloy Castings."*

Quad City . . Feb. 17 . . Fort Armstrong Hotel, Rock Island, Ill. . . M. C. Ehrman, Jr., International Harvester Co., *"Epoxy Pattern Equipment."*

Rochester . . Feb. 10 . . Seneca Hotel, Rochester, N. Y. . . H. R. Clauser, Material & Methods Magazine. *"What's New on Engineering Materials."*

Saginaw Valley . . Feb. 15 . . Bancroft Hotel Saginaw, Mich. . . *Annual Ladies' Night, Dinner Dance.*

St. Louis District . . Feb. 13 . . Edmond's Restaurant, St. Louis . . J. R. Nieman, Shell Process, Inc., *"Shell Mold for Profit in the Small Foundry."*

Southeastern Regional Foundry Conference . . Feb. 20-21 . . Patten Hotel, Chattanooga, Tenn.

Southern California . . Feb. 14 . . Rodger Young Auditorium, Los Angeles . . W. A. Geisler, Hansberg Shooter Div., Davenport Machine & Foundry Co. *"Core Shooting."*

Tennessee . . *See Southeastern Regional Foundry Conference.*

Texas . . Feb. 21 . . Marshall Hotel, Marshall, Texas . . S. F. Carter, American Cast Iron Pipe Co., *"Melting Practice for Steel Castings." Joint Meeting with East Texas Section.*

Timberline . . Feb. 10 . . Oxford Hotel, Denver, Colo. . . F. Newberry, Oklahoma Steel Castings Co., *"Pad Washing in the Steel Foundry."*

Toledo . . Feb. 5 . . Heather Downs Country Club, Toledo, Ohio. R. T. Lewis, Keen Foundry Co., *"Are Your Costs Reliable."*

Tri-State . . Feb. 14 . . Western Village Motel, Tulsa, Okla. . . C. A. Sanders, American Colloid Co., *"Casting Finish & Precision of Sand Castings."*

Twin City . . Feb. 11 . . Jax Restaurant, Minneapolis . . M. Bock, II, Exomet, Inc., *"Exothermic & Insulting Materials."*

Utah . . Feb. 18 . . Hot Shoppes, Salt Lake City . . W. A. Geisler, Hansberg Shooter Div., Davenport Machine & Foundry Co., *"Latest European Foundry Developments."*

Washington . . *No Information Available.*

Western Michigan . . Feb. 3 . . Doo Drop Inn, Muskegon, Mich., *"Segregation of Unbonded Molding Sands."*

Western New York . . Feb. 7 . . Sheraton Hotel, Buffalo, N. Y. . . C. V. Nass, Bearsley & Piper Div., Pettibone Mulliken Corp., *"New Processes for Small Foundries."*

Wisconsin . . *See Wisconsin Regional Foundry Conference.*

Wisconsin Regional Foundry Conference . . Feb. 13-14 . . Hotel Schroeder, Milwaukee.

MARCH

Birmingham District . . March 14 . . Thomas Jefferson Hotel, Birmingham, Ala. . . J. F. Orloff, Central Foundry Div., Saginaw Malleable Iron Plant, GMC, *"Gating to Control Pouring & Its Effect on the Casting."*

Canton District . . March 6 . . Mergus Restaurant, Canton, Ohio . . J. A. Babcock, Pickands Mather & Co., *Film on Mining & Smelting of Taconite Ore.*

Central Illinois . . March 3 . . American Legion Hall, Peoria, Ill. . . O. J. Myers, Reichhold Chemicals, Inc., *"Sand."*

Central Indiana . . March 3 . . Athenaeum Turners, Indianapolis . . H. H. Kessler, Sorbo-Mat Process Engineers, *"Gating & Risering."*

Central Ohio . . March 10 . . Seneca Hotel, Columbus, Ohio . . H. J. Weber, AFS, *"Legislation Affecting Foundries."*

Chicago . . March 3 . . Chicago Bar Association, Chicago . . E. C. Zirzow, Werner G. Smith, Inc., *"Why Four Methods of Coremaking?"*

Cincinnati District . . March 10 . . Suttmiller's Restaurant, Dayton, Ohio . . H. Brown, Metallurgical Associates, Inc., *"Techniques of Selling Castings—Profitably."*

Metropolitan . . March 3 . . Essex House, Newark, N. J. . . O. H. Kastens, Newaygo Engineering Co., *"Small Foundry Mechanization." Film and Discussion Period.*

Michiana . . March 10 . . Club Normandy, Mishawaka, Ind. . . C. A. Sanders, American Colloid Co., *"It's Not All Sand."*

Mo-Kan . . March 7 . . Fairfax Airport, Kansas City, Kans. . . C. E. Wenninger, Beardsley & Piper Div., Pettibone Mulliken Corp., and R. W. Trimble, Bethlehem Supply Co., *"Digging Into Sand Fundamentals."*

New England . . March 12 . . University Club, Boston . . L. W. Greenslade, Brown & Sharpe Mfg. Co., *"Problems of Gating & Risering."*

Northeastern Ohio . . March 13 . . Tudor Arms Hotel, Cleveland . . W. E. Sicha, Aluminum Co. of America, *"Production of Sound Castings."*

Piedmont . . March 7 . . Hotel Goldsboro, Goldsboro, N. C. . . R. A. Clark, Electro Metallurgical Co., Div. Union Carbide Corp., *"Gray Iron Foundry Practice."*

Rochester . . March 4 . . Hotel Seneca, Rochester, N. Y. . . G. L. Moore, Aluminum Co. of America, *"Designing Aluminum Castings for Production & Serviceability."*

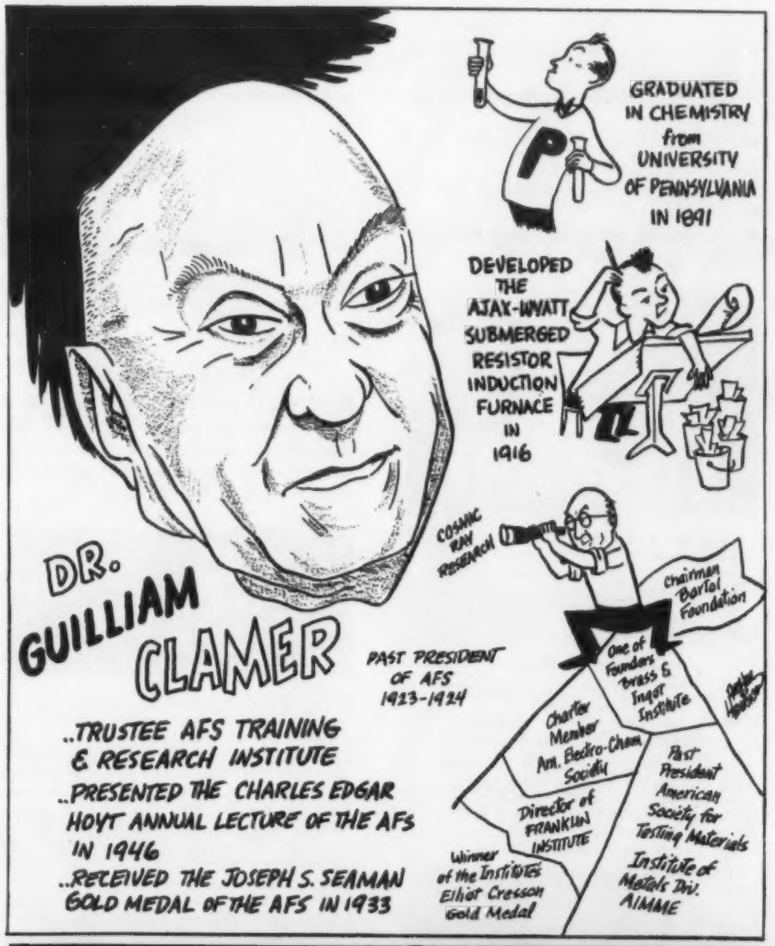
Saginaw Valley . . March 6 . . Fischer's Hotel, Frankenmuth, Mich. *Student Night.*

Timberline . . March 10 . . Oxford Hotel, Denver, Colo. . . W. M. Ball, R. Lavin & Sons, Inc., *"Non-Ferrous Melting Practice."*

Toledo . . March 5 . . Heather Downs Country Club, Toledo, Ohio . . B. H. Taylor, The B. F. Goodrich Co., *"Today's Challenge in Human Relations."*

Western New York . . March 7 . . Sheraton Hotel, Buffalo, N.Y. . . S. C. Massari, AFS, *"Horizontal Gating Systems."*

Twin City . . March 11 . . Jax Restaurant, Minneapolis . . M. K. Young, U.S. Gypsum Co., *"Models & Molds for Plastic."*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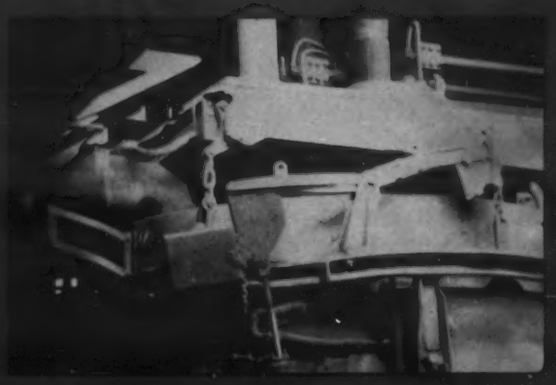
DEVELOPED THE AJAX-WYATT SUBMERGED RESISTOR INDUCTION FURNACE IN 1916
DR. GUILLIAM CLAMER
PAST PRESIDENT OF AFS 1923-1924
COSMIC RAY RESEARCH
Chairman Barlol Foundation
One of Founders Brass & Ingot Institute
Charter Member Am. Electro-Chem Society
Past President American Society for Testing Materials
Director of FRANKLIN INSTITUTE
Institute of Metals Div. AIMME
Winner of the Institutes Elliot Cresson Gold Medal
..TRUSTEE AFS TRAINING & RESEARCH INSTITUTE
..PRESENTED THE CHARLES EDGAR HOYT ANNUAL LECTURE OF THE AFS IN 1946
..RECEIVED THE JOSEPH S. SEAMAN GOLD MEDAL OF THE AFS IN 1933

Personalities

Before installation of fume collector, smoke and fumes escaped into the plant atmosphere.



After installation, plant is cleaner and the fumes can be cooled and piped to bag filters.

Smoke is drawn from the furnace through two holes near the periphery of the furnace roof.

CANADIAN FOUNDRY STIFLES SMOKING ARC FURNACE

Vancouver Steel experiments have developed a system that draws smoke directly from the furnace

J. R. Belyea / *Superintendent*
Vancouver Steel Ltd.
Vancouver, B.C.

The problem of controlling smoke and fume from industrial furnaces is rapidly becoming of paramount importance because of municipal laws governing the volume and density of allowable emissions.

In cases where smoke results from incomplete combustion, afterburners have been effective in reducing the density and volume of the smoke. However, in cases where the emission is a completely burned product, filtration is the only effective method of reducing the fume volume. Water sprays, bag houses and electrostatic precipitators filter by trapping or containing the fume in a vessel or pipe.

The Problems

Electric arc steel melting furnaces present a unique problem because the fumes vary in composition and intensity from time to time during the working of a heat. Large volumes of gases may be produced in very short times. These gases are hot and tend to rise rapidly, carrying with them minute solid particles of matter. As the electric furnace is a comparatively small vessel with a low roof, the gases readily escape from the furnace into the plant environment. Practically all the emissions are either oxides or become oxidized immediately upon contact with the air.

The conditions encountered in the electric furnace offer three problems: first, the collection of the fumes; second, cooling the fumes; third, filtration of the solid particles of oxidized matter from the fumes.

In some installations, hoods are placed over the roof and door openings of the furnace. Fumes are allowed to escape from the furnace into these hoods, from which they are drawn by vacuum into a pipe. Hoods of this type are apt to be cumbersome, particularly on larger furnaces. Also warpage, due to the high temperatures, decreases their efficiency. Such an installation is awkward to remove and replace during roof changes. The high cost and obvious limitations of conventional hoods led Vancouver Steel to experiment with a system of drawing the smoke directly from the body of the furnace before it could escape.

The main objectives were: prevent the smoke from the furnace filling the plant; and prepare the fumes for some type of cleaning procedure. The plant designed system now keeps the plant relatively clean and the fumes are captured in a pipe at a reasonable temperature.

Design Details

The installation was made on an 11 ft diameter electric arc furnace operating entirely on scrap steel.

The furnace is installed in a building which was formerly a power sub-station. Both ends of the building are open, the furnace being situated close to the south end of the building with the pouring floor occupying the north end of the building. The furnace is mounted so that the working floor is 15 ft above the floor of the pouring pit.

Smoke from the furnace, especially during inclement weather when the wind is in the southeast, tends to drift from the south end of the

Water-jacketed "Y" pipe is fitted to holes in the furnace.

building and fill the pouring pit with fumes. Working conditions at such times are unpleasant and hazardous, particularly when fairly large quantities of bundles are included in the furnace charge.

Smoke Route

By drawing the smoke off before it escapes from the furnace, the problem of recapturing smoke that has escaped into the plant is avoided. Smoke is drawn directly from furnace cavity through two 9 in. diameter holes near the periphery of the furnace roof, midway between the working door and the spout. The location of these holes was governed by the design and position of the furnace.

A water jacketed mild steel "Y" pipe was fitted on the two roof holes. This pipe brings the two 9 in. holes to a single 15 in. hole, and changes the direction of smoke travel from approximately vertical to horizontal. The water-jacketed roof ring supports the pipe, and cooling water by-passed from one of the electrode glands is passed through it. A small bleeder pipe was incorporated into the system to avoid steam pockets forming when furnace was tipped.

The remainder of the pipe is completely separate from the furnace. A water-jacketed elbow and vertical pipe direct the smoke down underneath the furnace working floor. A small water spray, introduced inside the water-jacketed elbow, serves the dual purpose of cooling the smoke and washing clean the inside of the vertical pipe, which would otherwise tend to become clogged. The spray is controlled by a solenoid valve, operated by a thermostat located on the outside of the vertical pipe directly below the water-jacketed section. The spray operates only when the pipe exceeds a set temperature approximately 20 per cent of the time.

A horizontal pipe beneath the furnace floor carries the smoke and water for 20 ft to a "T", where the smoke is drawn upwards through a fan. Water is drained out through a 4 in. pipe to a sump, and then to the drain.

The fan is 26 in. in diameter, with 15 in. inlet diameter and a rectangular outlet approximately 14 in. x 13 in. This fan is belt driven by a 25 hp variable speed motor which provides fan speeds of 2250, 2100, 1750, 1300, 1050, and 900 rpm. The blower is quite efficient for normal requirements when running at 1750 rpm.

An important design feature is the 2-in. air gap maintained between the furnace-mounted and floor-mounted pipes. This provision allows for roof swinging and furnace tipping. The gap also allows entry of clean air into the system. This air helps to cool the hot gases. Also, by following the periphery of the pipe for a short distance, this air apparently prevents deposition of dirt on the water-jacketed elbow section, as no cleaning of this part has been required.

Operation

Complete removal of all furnace smoke at all times has not been attempted. All smoke is removed from the furnace during the meltdown period. This smoke is trapped in a pipe at temperatures compatible with a bag-house operation.

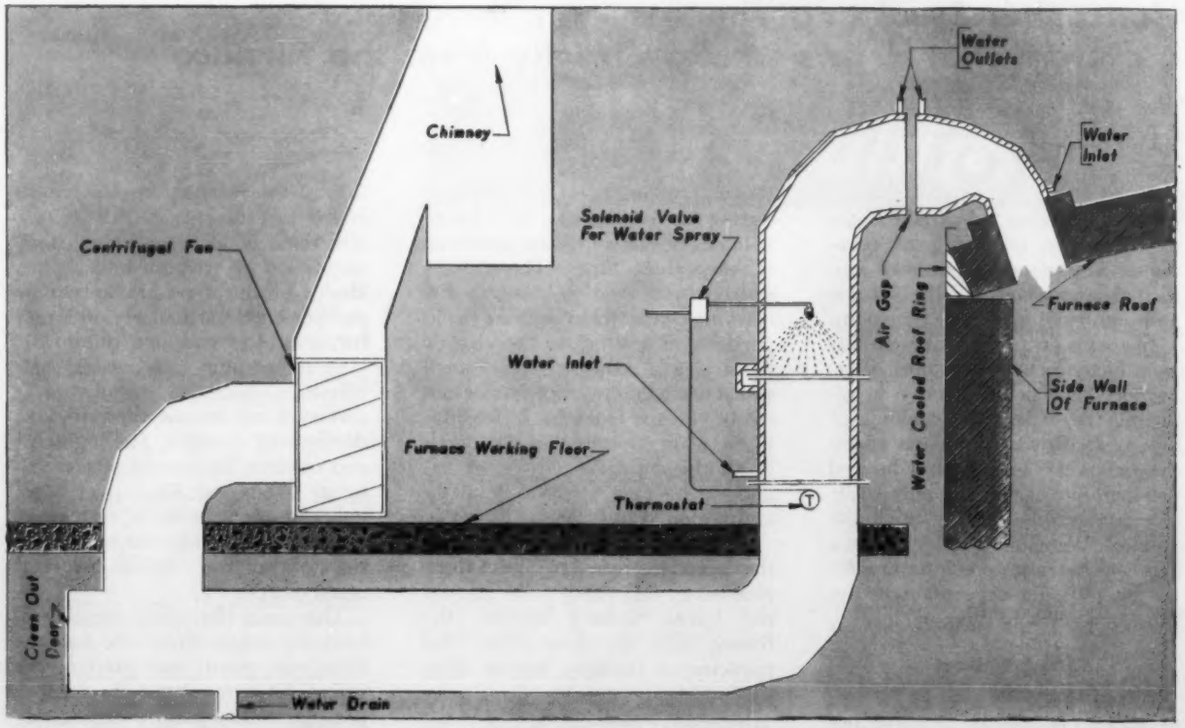
Little maintenance is required on the system. The "Y" section is cleaned by brushing and blowing with compressed air while the furnace is tipped during the pouring of each heat. The horizontal pipe is cleaned about once every two or three weeks.

In melting semi-killed steel, composition limits have been held with no difficulty attributable to the smoke system. No adverse effects on refractories or electrode consumption have been encountered.

All smoke is removed in meltdown periods when the furnace can be effectively sealed to exclude outside air. During periods when the door is open, the efficiency of the system drops, but this is not a drawback to the operation. Gas temperatures at the fan have never exceeded 410 F. This temperature is obtained for a matter of 2 to 3 minutes, at the start of the heat, when the arc is playing at the top of the charge. As soon as electrode tips are buried in the scrap, temperature drops rapidly to 175 F at the fan, and remains almost constant during the heat.

Total cost of the system, including all experiments and 2 years operation has been slightly in excess of $10,000.

■ To obtain single additional copies of this article, circle F, Reader Service Card, pages 7-8.



Smoke and fumes are collected and cooled by this installation.

Factors Affecting Casting Design Studied at Beloit

■ A cooperative industry-education program to promote a better understanding of foundry problems and processes was recently conducted at Beloit, Wis. Participating were Beloit Iron Works and the Vocational and Adult School of Beloit.

The objective of the course was to afford Beloit Iron Works engineering personnel an opportunity to increase their knowledge of pattern-making and foundry practices. It also allowed the patternshop and foundry departments a better understanding of the designer's problems.

This course, consisting of eight two-hour sessions, is a pre-requisite for a supplementary course on specific design problems relative to Beloit Iron Works operations.

The first session on *"Metallurgy as it Pertains to the Foundry,"* was presented by David Matter, Ohio Ferro Alloys Corp., Canton, Ohio. This covered the effect of changes on the chemical elements, the characteristic structures and properties of iron, heat treatment of iron, and general features of solidification.

James Miller, Beloit Iron Works, was the speaker at the second session. His topic, *"Cupola Practice"* dealt with the process of getting metal into molten state, pouring temperatures, and basic cupola construction.

Bert Baptist, Beloit Iron Works, conducted the third session, *"Non-Ferrous Metals."* This lecture was devoted to metallurgy, pouring and melting, molding, and design of castings.

Robert Speerbrecher, Wisconsin Vocation and Adult Schools, conducted the fourth session devoted to *"Pattern Fundamentals."* This meeting covered shrinkage, contraction, machine finishes, general design principles. Cores, core prints and patterns for mechanical molding were also discussed.

M. V. Holt, Beloit Iron Works, covered *"Ferrous Metals"* at the fifth class. Subjects discussed included physical and mechanical properties of gray and ductile iron, practice affecting physical mechanical properties of ferrous metals and other practice affecting physical and mechanical properties in producing quality castings.

George Schuller, Caterpillar Tractor Co., Peoria, Ill., conducted the sixth meeting. Discussing *"Design for Moldability."* Bert Baptist conducted the seventh and eighth classes dealing with molding practices.

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FEDERAL GREEN BOND BENTONITE
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The highest grade, pure Western Bentonite ideal for bonding regular synthetic sand systems containing fines, cereals, and residual clay. The L-J characteristic makes it possible to attain high green and dry compression strength with the addition of a minimum quantity of water. FEDERAL GREEN BOND L-J permits a thinner slurry and faster mulling; reduces the strain on pumps when used in a slurry system.

The "Best of the Bentonites" for 32 years, old reliable GREEN BOND is absolutely uniform, unadulterated and free from chemicals.

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GREEN BOND H-J*
(*High-Gelatinating)

GREEN BOND H-J means high gelatinating, and is mined exclusively for steel foundries where new or reclaimed sands are used. New sands, having no organics, fines, or residual clays to retain moisture, require the addition of high-gelatinating Bentonite for moisture retention.

FEDERAL GREEN BOND H-J absorbs and retains water better in such sands than any Bentonite you can use. This material completely meets steel founders' requirements.

GREEN BOND H-J may be furnished either granular or pulverized to conform to various mulling and air conditioning systems.

Send for H-J TEST SAMPLE

Archer-Daniels-Midland Company
Federal Foundry Supply Div.
2191 West 110th Street
Cleveland 2, Ohio

Will you please have your Technical Representative arrange for a test of GREEN BOND BENTONITE H-J in our foundry.

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____
STATE_____

Archer Daniels Midland company
FEDERAL FOUNDRY SUPPLY DIVISION
2191 West 110th Street • Cleveland 2, Ohio
Producers of core and facing binders, sea coal, sand stabilizers, core and mold coatings, and foundry facings

better chilled iron abrasives ...and why

We have specialized in the manufacture of metal abrasives since 1888. We have "grown up" with their expanding use. Such long contact with their production and use has given us unequalled know-how and experience in their manufacture.

A continuous program of research for the improvement of metal abrasives has been carried on with one of America's foremost metals research organizations since 1937.

We employ the most modern techniques in melting and processing to produce metal abrasives to exacting standards of chemistry, hardness, toughness and uniformity of these elements from one lot to another. It is more than significant that the two largest manufacturers of blast-cleaning equipment in the world sell and recommend Samson Shot and Angular Grit for best results in their equipment.

LEADERS in development of PREMIUM-TYPE ABRASIVES

The two best known names in premium abrasives were developments of two of our subsidiaries. MALLEABRASIVE, the first malleablized type of metal abrasive ever produced, set the pace for development of all other makes of premium abrasives. TRU-STEEL Shot was the first high-carbon all steel shot produced to meet demand for this specialized type of abrasive.

One of these products may do your blast-cleaning job better, and at lower cost. Write us for full information.

PITTSBURGH CRUSHED STEEL CO.
Arsenal Sta., Pittsburgh 1, Pa.

Subsidiaries: - - -
The Globe Steel Abrasive Co., Mansfield, O. (Malleabrasive)
Steel Shot Producers, Inc., Arsenal Sta., Pittsburgh (Tru-Steel)

Circle No. 347, Page 7-8

let's get personal

Albert P. Gagnebin and **L. E. Grubb** . . have been appointed assistant vice-presidents of The International Nickel Co., New York. Gagnebin continues as manager of the Nickel Sales Dept., and Grubb, formerly general superintendent of the Huntington, West Va. plant, will be in charge of labor relations at the company's United States plants, transferring to the New York office.

Fred W. Sherman . . formerly president of Adirondack Steel Casting Co., Div. Consolidated Foundries and Mfg. Corp., Watervliet, N. Y., has been elected vice-president of Consolidated Foundries and Mfg. Corp. **H. D. Phillips,** formerly vice-president, Adirondack Steel Casting Co., is the new president of that division of Consolidated.

A. R. Barnett . . vice-president, A. P. Green Fire Brick Co., Mexico, Mo., has been appointed director of A. P. Green Domestic Subsidiaries, including Canada. He has been associated with the company for 34 years. **J. J. Offutt** has been elected vice-president of the company, and appointed director of sales. He started with the firm in 1928.

Otto A. Pfaff . . has retired as president of Wheelabrator Corp., Mishawaka, Ind.; a past AFS director, he will continue as chairman of the board for Wheelabrator. **James F. Connaughton,** formerly executive vice-president, has been elected president.

James Alex . . president, Sterling Casting Corp., Bluffton, Ind., has been elected to membership in the Young President's Organization, Inc.—a national organization composed of persons who became presidents of their firms before reaching the age of forty.

William Ball Jr. . . R. Lavin & Sons, Inc., Chicago, spoke before the Oregon, Washington, and British Columbia chapters of AFS during January. His subject was "Copper-Base Alloy Foundry Practice."

William A. Meissner, Jr. . . has been appointed director of the Copper Div., Business and Defense Services Administration, U. S. Department of Commerce. Since December, 1952, he had been deputy director of the Copper Div.

American Colloid Co., Chicago, has announced the appointment of **George DiSylvestro** to the position of Director of Foundry Research. He will coordinate the research and development of the firm with actual foundry production.

Herbert J. Weber . . Director, AFS Safety, Hygiene and Air Pollution

A. R. Barnett

J. F. Connaugton

H. J. Weber

Control program, has been appointed chairman of two industrial committees: the Ferrous Foundries Committee, Air Pollution Control Association; and the American Standard Association Committee on Mechanical Cutting and Abrading.

Canadian Steel Foundries (1956) Ltd. has announced the appointment of **Paul von Colditz** to general works manager. He has been with the company since 1938, and is chairman of

Paul von Colditz

the AFS Eastern Canada Chapter. **M. E. Nixon,** formerly manager of sales, has been appointed to vice-president of sales.

Ajax Electric Co., Philadelphia, reports that **L. B. Rosseau** has been elected president and treasurer. Other elections were: **H. W. S. Schrader** to vice-president, and **B. R. Russell** to secretary. Retiring president, **J. E. Haig,** was one of the founders of the company 27 years ago.

Dr. Robert Thomson . . head of the Metallurgical Engineering Department, GMC, Detroit, was honored by the American Society For Metals at its National Metals Congress held in November at Chicago. He presented the 15th Annual William Park Woodside Lecture, "Are Metallurgists Prepared for 19XX?"

Dr. B. D. Thomas . . director, Battelle Memorial Institute, Columbus, Ohio, has been named to the presidency of the organization. He succeeds **Dr. Clyde Williams,** who is retiring. Thomas joined the staff as a research engineer in 1934.

Clinton Bennett . . has been appointed to the new post of field liaison engineer for Lewis-Shepard Co., Watertown, Mass. He will be responsible for all field liaison engineering assistance extended to the engineering, production, sales, and service departments.

IT'S UP TO YOU!

The students who are interested in the foundry industry today are the industry's management of tomorrow.

One of our jobs, as the Foundry Educational Foundation, is the encouragement of, and assistance to, these students.

Over the past nine years, as you can see from the accompanying chart, F.E.F. has made great strides in that direction. Sixty-four departments now require students to study the cast metals industry, as compared to only twenty in 1947.

This advancing trend will assure a continuing flow of capable, well-educated young men into our industry . . . **providing** your interest and financial support are maintained now and in the future.

DEPARTMENTS REQUIRING CAST METALS STUDY

20 1947

64 1956

Write for our new booklet, "Let's Look Ahead".

You'll be glad you did.

Foundry Educational Foundation

1138 TERMINAL TOWER BUILDING • CLEVELAND 13, OHIO

Circle No. 348, Page 7-8

H
W
Known By The
Company We Keep
As sales representatives for America's leading producers of quality foundry commodities, we are especially proud of our association with The Woodward Iron Company, the nation's largest independent producer of highest quality foundry and malleable pig iron since 1882.
For details see your H. W. Buyers Guide
WOODWARD IRON COMPANY
Hickman, Williams & Co.
(INCORPORATED)
CHICAGO · DETROIT · CINCINNATI · ST. LOUIS · NEW YORK
CLEVELAND · PHILADELPHIA · PITTSBURGH · INDIANAPOLIS
Established 1890
Circle No. 349, Page 7-8

foundry trade news

National Carbon Co. . . . Union Carbide Corp. division is now operating a plant at Lawrenceburg, Tenn., that uses a new process to cut manufacturing time of industrial carbon products from eight weeks to less than eight minutes.

Grie: Reproducer Corp. . . . New Rochelle, N.Y., die caster is building additions to its plant which will increase the facility to 150,000 sq ft. Expansion will permit doubled production capacity.

Alloys & Chemicals Mfg. Co., Inc. . . Cleveland firm has been appointed Detroit area distributor of standard alloy ingot for Kaiser Aluminum & Chemical Sales, Inc.

Metals Processing Div., Curtiss-Wright Corp. . . . displayed their foundry facilities and techniques at the company's recent *Tomorrow's Metals Processing Today* exhibit at the Waldorf-Astoria Hotel, New York.

Joseph Dixon Crucible Co. . . . New York, has recently celebrated its 130th anniversary. The company makes more than 3000 different industrial products, mostly graphite based, to serve 20,000 customers.

Gardner-Denver Co. . . . Quincy, Ill., has put two new metallurgical laboratories into operation; one will serve the plants located at the company's headquarters at Quincy, and the other is located at the Keller Tool Div., Grand Haven, Mich.

Albion Malleable Iron Co. . . . Albion, Mich., and Conexoes de Ferro Foz, Sao Paulo, Brazil, have signed a contract linking the two companies in an agreement for technical and manufacturing assistance in establishing the Foz foundry as a producer of malleable iron automotive castings.

There is essentially no automotive foundry industry in Brazil at present; the Foz company has a highly mechanized modern foundry for the production of whiteheart pipe fittings and plans an expansion into automotive production.

Metallurgical Associates, Inc. . . . New York, has announced a Sales Training Clinic for all casting salesmen entitled, *Techniques of Selling More Castings . . . Profitably!"* Harold Brown, vice-president of the foundry consulting firm, will direct the clinic which will be conducted in all major foundry areas throughout the country in 1958. The first clinic is scheduled for Jan. 21, 1958, at the Sheraton Hotel, Philadelphia.

Dominion Foundries and Steel, Ltd. . . Hamilton, Ontario, is installing what is said to be the largest and most powerful Cobalt 60 gamma radiography machine on the continent, and possibly in the world. The machine was made by Nuclear Systems Div. of The Budd Co., Philadelphia.

The unit will be used for the radiological inspection of large steel castings, some with metal sections up to nine in. thick.

Knute Palmquist Foundry, Inc. . . . Oakland, Calif., was recently awarded a safety award certificate by the Argonaut Insurance Group, the firm's workmen's compensation carrier' for an outstanding accident prevention record.

Deery Foundry Co. . . . Philadelphia, has been located in the same location for over 100 years. Throughout the foundry's existance, basic principles in the production of gray iron have not changed; but recently, industry has "re-discovered" gray iron as a low-cost metal with many uses, and is turning more and more to foundries such as Deery for castings.

John F. Deery, president of the firm, formed the corporation which purchased the assets of the Brinton Co., then owner of the foundry, in 1955; Deery had served as president of the Brinton Foundry for ten years.

An ever-increasing volume of its

production is in semi-steel and alloy castings, modifications of gray iron unheard of when the predecessor of the present Deery organization was founded. Modern technology has given the basic metal improved properties which make it economical for many industries to switch back to the metal for use in new applications.

Weight ranges of castings at the Deery plant vary from one ounce up to 8000 lb., and has been serving some of its customers for over 50 years. Deery points up the fact that, "The continuing relationship must be based on complete satisfaction with price and service."

Nelmor Mfg. Co. . . . Cleveland, has announced that the firm's president, David Morgenstern is in Israel to supervise the installation of a 275-ton Reed Prentice vacuum feed aluminum die casting machine. He and his father, Joseph, donated the machine to the Kibbutz Hatzor Cooperative Farm, near Tel Aviv. It will be used to produce die castings for irrigation and electrical systems.

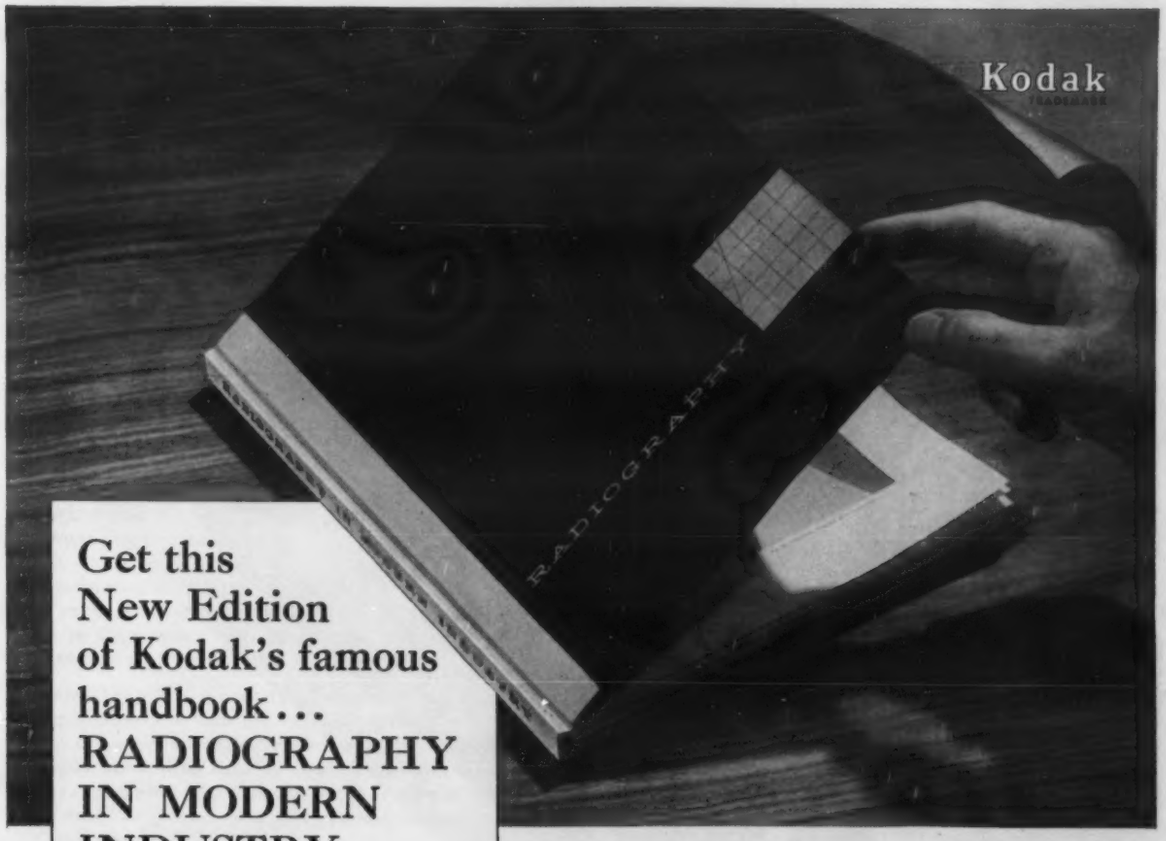
The machine's automatic vacuum feed device was invented by David Morgenstern, the patent of which was recently sold to the Package Machinery Co., Springfield, Mass.

Electric Steel Foundry Co. . . . Portland, Ore., has moved into its new office and warehouse in Denver, Colo. The new warehouse will carry stocks on stainless steel sheet, plate, pipe, tubing, bar, fasteners, valves, fittings, and polyvinyl chloride plastics.

American Steel Foundries . . . Chicago, has reported to its stockholders that the net income for fiscal 1957, amounted to $8,088,000, second largest in the company's history.

Total sales jumped from roughly $117,000,000 for fiscal 1956 to about $122,500,000 in fiscal 1957. The gain in sales was largely attributed to increased volume of Griffin Steel Foundries Ltd., Canada, and shipments from the Griffin Wheel Co. steel wheel plant, Colton, Calif., which opened in May, 1957.

Blaw-Knox Co. . . . Pittsburg, Pa., was awarded the National Safety Council's award for perfect safety during the contest year—July 1, 1956 to June 30, 1957. At the 45th National Safety Congress and Exposition held in October at Chicago, employees of the company's Coraopolis Works were recognized as completing over one million safe man hours during the year. This was the first time in National Safety Council history that a steel foundry won this award.



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An authoritative, up-to-the-minute text which explains the fundamentals of x-rays and gamma rays, and their use in radiography for industry.

Everyone interested in industrial radiography should have the latest edition of this famous handbook. It contains all the information found in the previous text, plus up-to-the-minute additions. It tells about new technics, new sources of radiation, and new fast films; explains proper methods of using them.

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- 140 pages of information
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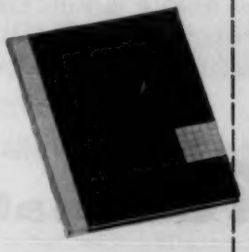

EASTMAN KODAK COMPANY 236-2
X-ray Division, Rochester 4, N. Y.
Gentlemen: Enclosed is $5.00. Please send me "Radiography in Modern Industry."

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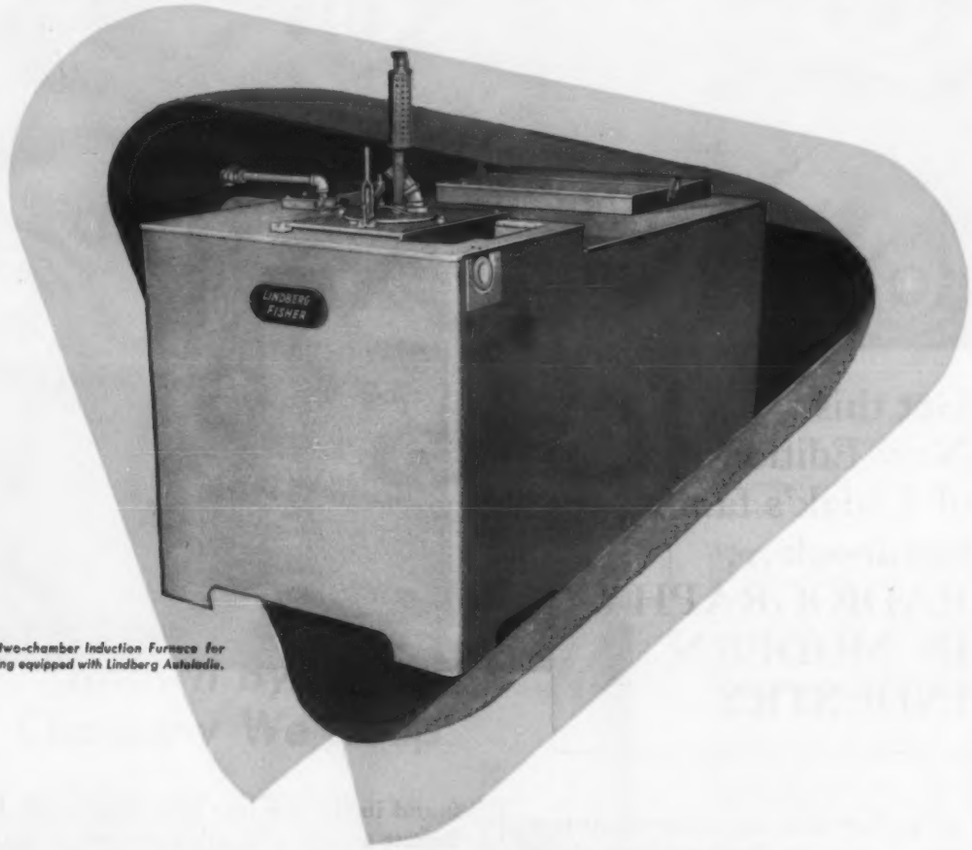
Circle No. 350, Page 7-8

Here's the ideal combination for casting aluminum automatically



Lindberg-Fisher two-chamber Induction Furnace for melting and holding equipped with Lindberg Autoladle.

Do you die-cast aluminum? Then take Lindberg's famous two-chamber induction melting and holding furnace, add "Little Joe" Lindberg's new automatic pump, and you'll have the most efficient automatic combination anywhere. The Lindberg-Fisher two-chamber furnace *melts* in one chamber, *holds* metal at precisely the right temperature in the other chamber, and "Little Joe" automatically delivers exactly the right size shot to the casting machine. With this combination all handling of molten metal is eliminated, perfect control of metal temperatures and shot size is maintained, and all automatically. For safer, more economical, more precise handling of aluminum or any non-ferrous metals or alloys better see Lindberg. Just get in touch with the Lindberg plant or the Lindberg Field Representative in your locality, or write Lindberg-Fisher Division, Lindberg Engineering Company, 2440 West Hubbard St., Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Ave., at Downey, California.

LINDBERG heat for industry

Circle No. 351, Page 7-8

industry in action

I.C.I. Hears Facts About Russian Steel Production

■ Highlighting the Fifth Annual Meeting of the Investment Casting Institute, held in Chicago Nov. 19-21, were talks on induction melting versus carbon arc melting, sales promotion of investment castings, and a look at steel production and life behind the iron curtain.

The three-day session included directors and committee meetings the first day, technical sessions on the second, with business sessions comprising the final day's activities.

The technical sessions included *"Advantages and Disadvantages of Induction Melting and Carbon Arc Melting,"* L. J. DiNuzzo, General Electric Co., Schenectady, N. Y.; *"Engineering Properties of Low Melting Plastic Pattern Material,"* C. J. Marsel and L. Kramer, New York University, and A. Saunders, Alexander Saunders & Co., New York.

"Production Control," R. H. Roehl, Howard Foundry Co., Milwaukee; *"Test Procedures for Proprietary Investments,"* an investment clinic directed by T. E. Moore, Ransom and Randolph Co., Toledo, Ohio; and *"Test Procedures for Pattern Materials,"* Paul Solomon, Yates Dental Mfg. Co., Chicago.

In his talk on alloy melting, L. J. DiNuzzo stated his purpose to be comparing induction and carbon arc melting techniques with reference to design of part to be cast, relative cost, control or reproducibility of results, and versatility. He concluded induction melting is more versatile, lending itself to use with new techniques.

Production control as "the effort of producing the right thing, in the right quantity, and at the right time," was related by R. H. Roehl in his address to the Institute. He outlined his company's production control system for Howard Foundry's Investment Casting Division.

Also featured was an account of a recent tour of Soviet steel mills in Russia and Siberia, Dr. N. J. Grant, Massachusetts Institute of Technology.

New G.I.F.S. Book on Gray and Ductile Iron Castings

■ The Gray Iron Founders' Society, Inc., has announced its new publication, Gray Iron Castings Handbook, said to be the first complete handbook ever written on gray and ductile iron castings. The 620-page book contains information on how to design, purchase, and use gray, ductile, white, and high alloy iron castings.

Designers will find the book useful as aiding in rapid and economical translation of a projected design into a finished product. *Purchasing agents* will appreciate data describing kinds of foundries, casting processes, type of patterns, inspection, and shipping methods.

Production executives will find guides to the selection of tool materials and grinding cutting tools for machining, heat treatment methods, and finishing operations. For *management executives* there is general information on how improved gray irons result in more economical production.

The book is divided into 11 chapters entitled: Gray Iron—Old as Antiquity, New as Tomorrow; Advantages of Iron Castings; Design of Gray Iron Castings; Specifying and Purchasing; Properties; Properties of Ductile Iron; White and High Alloy Cast Irons; Heat Treatment of Gray Iron; Welding, Joining and Cutting of Gray Iron; Machining and Grinding; Metallic and Non-Metallic Coatings for Gray Iron. Copies may be purchased from the Gray Iron Founders' Society, Inc., Cleveland.

COLEMAN OVENS

turn minutes into money...

Coleman Tower® Oven

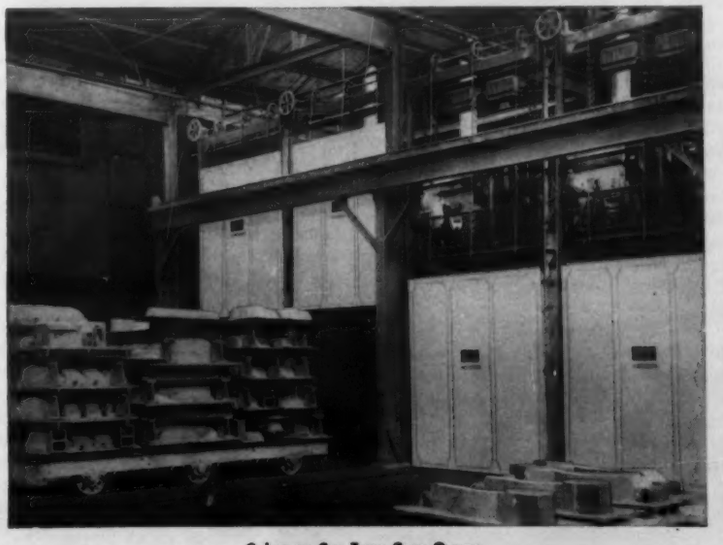
Fast, efficient production of uniformly good cores and molds is vitally important to foundry profits.

When you use old, out-dated core and mold ovens the minutes and hours lost in costly rejects and make-overs . . . the time and effort lost in wasted man power, the production lost in casting scrap eat your profits away. Modern design and exclusive advantages of Coleman Ovens result in immediate production economies, reducing overall core department costs by as much as 50%! Such savings mean increased profits and rapid investment amortization.

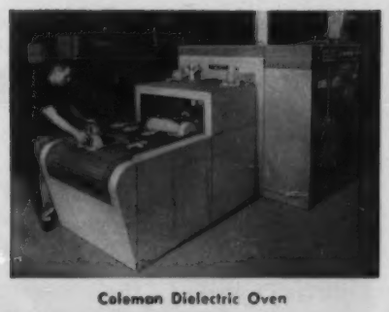
More than half a century of specialized foundry oven experience is your assurance that the Coleman Oven recommended to you will do your work to your complete satisfaction. ***As builders of the world's only complete line of foundry ovens we have no reason to recommend any but the best for your purpose.*** Let our experienced engineers give you practical suggestions for your particular requirements.

WRITE FOR BULLETIN 54

Coleman Transrack Ovens



Coleman Car-Type Core Ovens



Coleman Dielectric Oven

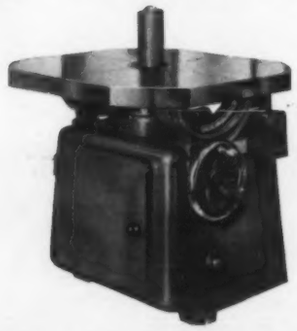
A COMPLETE RANGE OF TYPES AND SIZES . . .
for every core baking and mold drying requirement:
Tower Ovens • Horizontal Conveyor Ovens
Car-Type Core Ovens • Car-Type Mold Ovens
Transrack Ovens • Rolling Drawer Ovens
Portable Core Ovens • Portable Mold Dryers
Dielectric Core Ovens

THE FOUNDRY EQUIPMENT COMPANY
1825 COLUMBUS ROAD **CLEVELAND 13, OHIO**

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

Circle No. 352, Page 7-8

New OLIVER Spindle Sander



Heavy duty Spindle oscillates and rotates to sand edge of scroll work on patterns

Sands difficult work with ease and accuracy. Its 1-inch spindle rotates at 1800 r.p.m. and oscillates 1⅛" with 56 strokes a minute. Spindle tilts up to 45° toward operator, 5° away from him. Takes drum 2", 4", 6" diameter, 9" long. Spindle adjustable vertically to permit full use of sanding area. Write for Bulletin 381.

Oliver makes a full line of woodworking equipment for pattern shops

OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICH.
Circle No. 353, Page 7-8

FOUNDRY SAND TESTING HANDBOOK

1—Completely rewritten by prominent foundry sand specialists

2—Twice as much information as contained in 5th edition

3—Includes a glossary

4—Includes a bibliography

5—259 pages . . . 93 illustrations

CHAPTERS COVER: Methods for Determining Fineness of Foundry Sands . . . Determining Moisture in Foundry Sand . . . Determination of Permeability of Foundry Sands . . . Strength of Foundry Sand Mixtures . . . Method for Determination of Green Surface Hardness—etc.

AFS Members $3.50
Non-Members $5.25

order from:

AMERICAN FOUNDRYMEN'S SOCIETY
Golf & Wolf Roads, Des Plaines, Ill.
Circle No. 354, Page 7-8

Build an idea file for plant improvements. Reader Service Cards, page 7-8 will bring more information . . .

for the asking

Shell molding silicone parting agents brochure describes how to break-in patterns; how to clean patterns; how to obtain easy release of sand-resin shells and cores with solvent-type silicone parting agents. *Dow Corning Corp.*
Circle No. 241, Page 7-8

Die casting machines, die design and construction, metallurgy, foundry practice, finishing die castings and management-labor relations covered in comprehensive article containing the findings of 31 die casting experts from 11 European countries. *Apex Smelting Co.*
Circle No. 242, Page 7-8

Precision casting process brochure specifies types of alloys utilized for "Accu-Cast" castings. States pattern requirements, provides information on annealing and heat treating, and emphasizes Manco facilities for technical aid and for production guidance. *Manco Products, Inc.*
Circle No. 243, Page 7-8

Stainless steel casting procedures reprint available. Describes proper techniques for design engineers. Text accompanied by 27 diagrams illustrating methods for achieving section uniformity, satisfactory joining sections, pressure tightness. Four tables included with typical casting problems and solutions. *Cooper Alloy Corp.*
Circle No. 244, Page 7-8

Sand conditioning unit features aeration, blending and mixing plus magnetic separation. Bulletins state Royer Magna-San cuts sand conditioning costs, increases yield and quality of castings—cleans up to 45 tons sand per hour. Hopper fed from three sides, only 7½-ft long, portable or stationary models. *Royer Foundry & Machine Co.*
Circle No. 245, Page 7-8

Job evaluation technique in small industry summarized in newsletter. Involves four main steps: analyzing the job, writing up job sheet, making the classification, and pricing job. States that evaluation is not an exact science but a logical and methodical way of guiding judgements. Of interest to personnel management especially. *Small Business Administration.*
Circle No. 246, Page 7-8

Sand hog which is self propelled, self feeding, complete sand conditioning, with high capacity, featured in bulletin. Specifications, schematic drawings, and several illustrated performances given. *Royer Foundry & Machine Co.*
Circle No. 247, Page 7-8

Water-cooled cupola study given in color 6-p illustrated brochure. Traces technical history of water cooled cupolas—designed to operate without a lining at high rates of thermal efficiency. *Whiting Corp.*
Circle No. 248, Page 7-8

Tax guide for small business, 1958 edition, published by Internal Revenue Service. Consists of 128 pp of explanations and answers to most tax problems which are confronting corporations, partnerships, and sole proprietorships. *Superintendent of Documents, U.S. Government Printing Office.*
Circle No. 249, Page 7-8

Leasing foundry equipment becomes a widespread practice according to study by United States Leasing Corp. Free copies available giving information of major virtues of leasing, freeing of working capital for sales expansion, eliminating obsolescence and disposal of work equipment.

Said to have tax-saving advantages, mainly tax postponement, and to be of value especially to industries whose ratio of fixed assets to tangible net worth is greater than 30 per cent. Foundry industry reputed to be 48 per cent, machine shops, 44 per cent. *Foundation for Management Research, Inc.*
Circle No. 250, Page 7-8

Supervoltage radiography, 26-p catalog, describes new approach, advantages to industry, superior-quality results and lowered production costs. Case histories, comparison chart, and x-ray intensity distribution graph are included. *High Voltage Engineering Corp.*
Circle No. 251, Page 7-8

Accoloy stainless and heat resistant castings brochure explains castings engineered for efficiency in design and said to give long service life. *Alloy Engineering & Castings Co.*
Circle No. 252, Page 7-8

Stainless steel book for product designers contains detailed charts, tables, case histories. Selection, sizes and shapes, manufactured units, forming, joining, finishing and designing well illustrated throughout 40pp. *Electro Metallurgical Co.*
Circle No. 253, Page 7-8

Industrial conveyor and elevator belting catalog entitled "A Guide to Maximum Belt Life." Engineering handbook published to simplify process of choosing proper equipment.

Valuable chart, technical data, and formulae are included. Photographs and diagrams used to show typical installations. *Imperial Belting Co.*
Circle No. 254, Page 7-8

Ceramic gating components catalog covers all standard cores, splash cores, elbows and tubes. Dimensions, standard package and weights tabulated.

Easily read graph presents the rates of metal delivery through every size strainer cores in lb as well as cubic in.-per-sec as function of head pressure. *Universal Clay Products Co.*
Circle No. 255, Page 7-8

High-frequency induction heaters and induction melting furnaces are described in 10-p catalog. Available in output ratings from 10 to 100 kw. Completely self-contained heater is used for rapid soldering, annealing, melting, brazing and hardening operations. Motor-generator induction

heaters produced with output ratings from 15 kw to 1250 kw at frequency ratings of 960, 3000 and 9600 cycles. *Allis-Chalmers Mfg. Co.*
Circle No. 256, Page 7-8

Electric furnaces, standard and special, for continuous heat processing production explained in illustrated brochure. Also shown are 10 types of furnaces and the processes for which they are used. *Harper Electric Furnace Corp.*
Circle No. 257, Page 7-8

Cutting and gouging torch speeds metal removal. Grooves, cuts gouges or bevels any metal by melting it with electric arc then blowing away melted metal with a continuous jet of compressed air directed at point of arc. Torch used in any position and jet air is always aligned with the point of arc. *Arcair Co.*
Circle No. 258, Page 7-8

Variable speed-snagging grinders bulletin available. Shows single wheel and double-end twin-motor specifications for 60 cycle AC grinders, horse power, wheel diameter, face, hole, flanges, speed range, floor space, and weight. *Foundry Grinder Div., Standard Electrical Tool Co.*
Circle No. 259, Page 7-8

Abrasive with steel shot characteristics at malleable prices described in bulletin which introduces this new item as a reputed faster, better cleaning, abrasive. Manufactured as shot and grit according to S.A.E. specifications. *Metal Blast, Inc.*
Circle No. 260, Page 7-8

Ceramic strainer cores, machine made under high pressure from smooth ceramic material. Said to obtain an even flow of metal through the holes of the strainer allowing metal to be poured at faster rate than with a sand core. Send for letter and specifications. *Du-Co Ceramics Co.*
Circle No. 261, Page 7-8

Automatic conveyor systems serving every type of industry—foundry, coal, wool, pulp, ore and sand. Literature describes complete conveyor systems designed, built, installed tested to specifications. *J. C. Corrigan Co.*
Circle No. 262, Page 7-8

Single line, hook-on buckets are subject of pictorially illustrated catalog designed to show many advantages of buckets. *Erie Strayer Co.*
Circle No. 311, Page 7-8

Pneumatic scrubber designed for easy installation, operation and maintenance for small or large foundries. Fifteen outstanding advantages are listed in bulletin with technical draw-

"Allis-Chalmers fork trucks are tougher and require less maintenance"

— says Chief Mechanic

"I think one reason the Allis-Chalmers trucks have outperformed the others is because they are easier to clean and service," continues Milt, the chief mechanic at Neenah Foundry Co., Neenah, Wisconsin. "I like the overhead valves and wet cylinder sleeves. I'm glad to see that they are replacing the old trucks with Allis-Chalmers trucks. This is going to make our job a lot easier."

Allis-Chalmers fork trucks *are* replacing other makes of trucks in the plant, because, according to J. P. Keating, vice-president, "On checking with operating and maintenance departments, we definitely feel your equipment is much better than competitive models. Design features, combined with the proved and dependable Allis-Chalmers engine, make this an outstanding industrial truck. We therefore recommend it without reservation."

Let your Allis-Chalmers material handling dealer give you the complete story on why owners, operators, servicemen — everyone likes Allis-Chalmers fork trucks. Better yet, let him demonstrate one and you'll see for yourself.

MATERIAL HANDLING DEPARTMENT, BUDA DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

Mr. Gast, operator of one of the Allis-Chalmers fork trucks at the Neenah Foundry says: "This truck must have been engineered for the driver. The parking brake is the best I've ever used. The shifting is handy, it speeds up my operation . . . I like where the hydraulic controls are located."

BH-40

Circle No. 355, Page 7-8

For the Asking

ings of lateral cross section of pneureclaim compartment and longitudinal cross section of two compartment unit. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

Circle No. 263, Page 7-8

Core sand mixers bulletin shows condensed specifications of five standard size supermix machines supplied either portable with pneumatic tires; or as stationary models mounted on steel skids. Blending action said to produce strong permeable cores in 50 per cent less time. *United States Forge & Foundry Co. Construction Equipment Div.*

Circle No. 264, Page 7-8

Conveying system do-it-yourself installation work book, believed to be first practical printed guide to setting up conveyor lines. Jammed with 20pp of useful information dealing with many types of easily installed conveyors. Charts on conveyor types and symbols show which are best for permanent and portable floor to floor installations. Simplified question—answer format, graph paper for plotting conveyor line, and 500 case histories included. *A. B. Farquhar Div., The Oliver Corp.*

Circle No. 265, Page 7-8

Most every Foundryman . . . .

Nearly all foundrymen today realize the need for keeping close check on their metal temperatures. And nearly all use Marshall Enclosed-Tip Thermocouples to make certain their metals are poured when temperatures are just right.

Marshall Thermocouples in the foundry are handy and dependable instruments. They measure temperatures of molten brass, bronze, aluminum and magnesium without trouble or delay. They are easy to use, and withstand repeated immersions. You can have them in types for furnace or ladle use.

Write for descriptive literature to: L. H. Marshall Co., 270 W. Lane Ave., Columbus 2, Ohio.

Photo City Pattern Foundry & Mach. Co.

Circle No. 356, Page 7-8

Blast cleaning catalog, 32pp, covers airless blast cleaning machines, wet blast, air blast, dust control equipment, cast steel shot and grit abrasives, sandcutters, and also core rod straighteners. Listed for the first time is complete new line of heavy duty, high efficiency batch-type centrifugal blast-cleaning machines, available in three sizes. *Wheelabrator Corp.*

Circle No. 266, Page 7-8

Vocational guidance leaflet aimed to stimulate interest of pre-high school age boys in training for various foundry occupations. Occupations covered include molding, melting, pouring, designing, pattern-making, and testing. *Crucible Manufacturers' Association.*

Circle No. 267, Page 7-8

Tentative standard test reprint for determination of loss on ignition of resin-sand mixtures developed by the Shell Molding Materials Testing Committee (8-N), American Foundrymen's Society. Object of test, the step-by-step procedure in making test, are given as helpful hints for foundrymen. *Chemical and Metallurgical Div., General Electric Co.*

Circle No. 268, Page 7-8

Chemical charts for synthetic safety clothing available in booklet form. Information given on resistances to inorganic and organic acids, alkalies, salts and solvents at varying concentrations and temperatures for Dynel, Orlon, Dacron, Acrilan and vinyl-coated fabrics and for vinyl and polyethylene films. Also covers fire-resistant, anti-static, liquid repellant, and lint-free properties of synthetic fabrics for work clothes. *Milburn Co.*

Circle No. 269, Page 7-8

Sling chains, featured in comprehensive, concise 4-p bulletin, which lists 7 main points to consider when ordering chains. Chart gives working load limits of 2-leg chains. *American Chain & Cable Co.*

Circle No. 270, Page 7-8

Steel-flo flour additive data in handy pocket-secretary form. Shows the preparation, recommended use, properties and price schedule. *American Colloid Co.*

Circle No. 271, Page 7-8

Integrated metal process fabrication techniques are presented in technical catalog. Illustrations, graphs, chemical analysis given for transverse properties of MPD cast products; also fatigue strength, impact strength, elevated temperature strength, and mahinability. *Metals Processing Div., Curtiss-Wright Corp.*

Circle No. 272, Page 7-8

Vacuum arc-welding equipment selection is keyed to provide buyer's guide to new equipment in 4-p manual. Analysis designed to cut waste, determine major factors, basic rules, correct use, choice of currents, and flexibility. *General Electric Co.*

Circle No. 273, Page 7-8

Materials handling tips offered in folder containing timely engineering data. Message regarding economies, accessories, available for speeding operations. Offers specific solutions to problems involving different types of loads—fork lift trucks with capacities from 1500 to 40,000 lb and material carriers with capacities ranging up to 60,000 lb. *Towmotor Corp.*

Circle No. 274, Page 7-8

Fork-lift truck operation brochure is cartoon-illustrated. Lists safety tips and serves as a guide in setting up a fork-truck driver training course. Among topics discussed are selecting operators, classroom instruction, driving instruction and maintenance responsibilities of the trained operator. *Lewis-Shepard Products, Inc.*

Circle No. 275, Page 7-8

Snagging wheels for removal of metal surface imperfections described in 4-p bulletin. Illustrations show typical applications on small castings and steel slabs, and the available range of all standard wheel shapes. Handy specification table includes sizes and types, and specification code marking. *Simonds-Worden-White Co.*

Circle No. 276, Page 7-8

Carbon and sulphur analysis accessory items listed in new brochure. Among items are Leco purifying train with rotometer tower, oxygen baffles, dust and sulphur traps, wetting and lubricating agents. *Laboratory Equipment Corp.*

Circle No. 277, Page 7-8

Coreless induction melting furnace for ferrous and non-ferrous metals, 4-p brochure gives detailed information on improved properties obtained through 60 cycle electromagnetic stirring action of new type German furnace. Condensed technical data included. *Ajax Engineering Corp.*

Circle No. 278, Page 7-8

Electric furnace brochure includes technical data sheet and price list. Offers forty standard models said to be the ultimate in furnace operation and temperature control for any heat

treating industry. *Industrial Div., L & L Mfg. Co.*

Circle No. 279, Page 7-8

Castings correction program advice in newsletter suggesting you correct weak spots in purchase of metal castings, analyze and correct costly time-consuming delays. Circle No. 312 to receive this valuable monthly release. *The Metal Castings Advisor.*

Beryllium-copper alloy catalog, 8 pp, describes melting, casting, and heat treating. Contains 3 tables showing composition and properties of beryllium-copper and beryllium-nickel alloys. Recommended temperatures for solution annealing and maximum properties for age-hardening given. *Brush Beryllium Co.*

Circle No. 280, Page 7-8

High temperature tooling and corrosion resistant alloy technical bulletin. Discusses alloy tooling designed for your requirements. Describes new techniques for producing 283,000 psi aircraft castings. *Alloy Engineering and Casting Co.*

Circle No. 281, Page 7-8

Rotoblast and dust control news reports case history of replacement of pickling at Midland Steel by mechanical descaling process. New installation claims to increase production, reduce floor space requirements, eliminate troublesome acid disposal problems, simplify materials handling. *Pangborn Corp.*

Circle No. 282, Page 7-8

Abrasive protection material used as a liner, curtain, throw mat or pad. Send for catalog sheet explaining how Armorite outwears steel 10 to 1 when used for lining: chutes, hoppers and other wearing surfaces handling ore, sand or gravel; sand blast cabinets; cyclone collectors and fan housings for abrasive dusts. *B. F. Goodrich Co.*

Circle No. 283, Page 7-8

Industrial ovens, spray booths, parts washer, and dust collectors featured in 4-p brochure. Design, operation, maintenance, cutaway photographs, dimensional drawings shown. *Newcomb-Detroit Co.*

Circle No. 284, Page 7-8

Eye and face protection featured in colorful catalog describing goggles, glasses, lenses, welding helmets, hand and face shields and respirators. *Sellstrom Mfg. Co.*

Circle No. 285, Page 7-8

Malleable iron castings characteristics and advantages outlined in 8-p brochure. Designed for use in cost reduction by purchasing departments. Brochure has sections on machinability, cold forming and impact resistance.

Specification tables for standard and pearlitic malleable iron are included. Stresses advantages to be obtained by designers and purchasers of castings from consultations conducted with foundry engineers. *Malleable Founders' Society.*

Circle No. 286, Page 7-8

Industrial television for the metals industry discussed in publication showing recommended uses, new systemized models, installation, operation, and maintenance. *Radio Corp. of America.*

Circle No. 287, Page 7-8

Foundry flask selection and maintenance pocket-book lists specifications for ordering, recommended bushing and pin tolerances, depth of drag and cheek, and other material of importance in the selection of correct type and size of foundry flasks. *Sterling Wheelbarrow Co.*

Circle No. 288, Page 7-8

Crane handling cost-reduction bulletin explains a new 5000 lb Rol-A-Draw all-hydraulic machine. Floor mounted, rolls over and draws patterns and core boxes to 30 in. Said to automatically handle any flask or core box within its wide range without machine adjustment. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

Circle No. 289, Page 7-8

Materials handling tips in pocket-sized "Preventative Service Manual" are aimed at keeping down-time to a minimum. Offers 32-point check-list which helps user avoid unnecessary repairs; aids in spotting trouble; provides in-plant servicing. *Towmotor Corp.*

Circle No. 290, Page 7-8

Gray iron structure control, mechanical properties, and carbon equivalent are described in 4-p technical article. *Vanadium Corp. of America.*

Circle No. 291, Page 7-8

Epoxy dermatitis booklet, 12 pp, lists 36 specific and practical rules for prevention. Recommendations are grouped under five headings: education of workers and supervisors; company housekeeping; ventilation; personal cleanliness; and use of protective creams and clothing. Recommendations are based on practical experiences of epoxy manufacturers, public health agencies, and insurers. Free copies available for distribution to all employees handling epoxy resins. *Milburn Co.*

Circle No. 292, Page 7-8

Patternmaking brochure describes modern facilities for production of wood, metal and plastic patterns, shell mold patterns and prototypes to meet the most exacting foundry demands. Equipment is described and pictured in both wood and metal pattern shops. *City Pattern & Foundry Co.*

Circle No. 293, Page 7-8

Silicone reference guide encompasses over 150 silicone products commercially available. Contains detailed charts, tables, graphs and data on performance and properties. Cross-indexed for handy reference. *Dow Corning Corp.*

Circle No. 294, Page 7-8

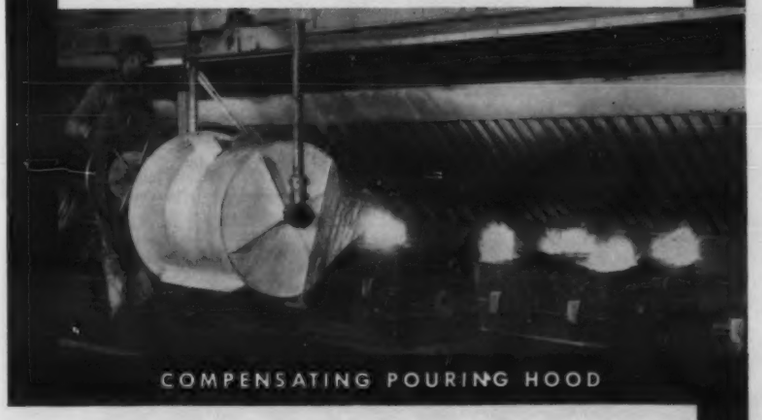
Alloy, with high-temperature strength and oxidation resistance to 220 F, explained in 28-p technical catalog. Graphs, schedules, and guides show chemical composition, physical properties, oxidation resistance, hardness, formability, rupture and creep data. Alloy X available in cast and wrought form. *Haynes Stellite Co., Div. Union Carbide Corp.*

Circle No. 295, Page 7-8

Welding supplies 48-p catalog available. Contains over 100 illustrations. Complete information on ferrous and non-ferrous welding rods for oxyacetylene welding and Heliwelding, welding and brazing fluxes and their applications, glare protection spectacles,

SCHNEIBLE

A HOOD THAT'S A FRIEND OF EVERY FOUNDRYMAN



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Clean, fresh air summer and winter, is what you enjoy with a Schneible Compensating Air Hood.

This hood includes air direction controls which allows efficient dust and fume collection without sacrifice of worker comfort.

Many sizes and capacities are available for both jobbing and production foundries.

Our representative will be glad to discuss your problem with you, or wire direct for complete details.

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Company _____
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City _____ Zone _____ State _____

SERVING FOUNDRYMEN THE WORLD OVER

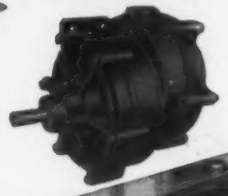
Circle No. 357, Page 7-8

AJAX LO-VEYORS

are cutting costs

in Large Plants in Small Plants

AJAX Open Pan Lo-Veyor



AJAX-Shaler-Shaker Drive

AJAX Closed Pan Lo-Veyor

AJAX Tubular Lo-Veyor

Plant layout men know that materials flow lines are never a static affair. That's why more and more AJAX LO-VEYORS are being used to give maximum flexibility to operations in large plants and small plants, indoors and outdoors.

AJAX LO-VEYORS are compact, self-contained units that can be suspended from ceilings, along walls, under or at floor levels, giving maximum flow capacity in limited space. They can be quickly and easily installed and or relocated with a minimum of cost and production down time.

AJAX LO-VEYORS in open and closed pan and tubular types meet every requirement of tonnage, speed, sanitation, abrasive and explosive conditions.

Write the factory TODAY for Bulletin No. 39 and name of your nearby AJAX Representative.

AJAX FLEXIBLE COUPLING CO. INC.

WESTFIELD, N. Y.

Circle No. 358, Page 7-8

SIZED TO FIT YOUR CUPOLA

You can choose from 5 sizes when you specify Semet-Solvay Foundry Coke. Each is the best you can buy—uniform in analysis, sturdy and blocky in structure. Call your Semet-Solvay man today.

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In Canada: SEMET-SOLVAY COMPANY, LTD., Toronto

Western Distributors: WILSON & GEO. MEYER & CO., San Francisco

For Better Melting

Circle No. 359, Page 7-8

and other pertinent material. *Air Reduction Sales Co.*

Circle No. 296, Page 7-8

Which Core Process, reprint, 6 pp, discusses four major coremaking processes with a comparison of the advantages and the disadvantages of each. *Archer-Daniels-Midland Co.*

Circle No. 297, Page 7-8

Hydraulic setting, castable refractory, named Tasil No. 413, described in bulletin covering uses, properties and directions. Said to have the advantages of high refractoriness, ample hot strength, ease and low cost of installation. *Chas. Taylor Sons Co.*

Circle No. 298, Page 7-8

Advanced materials technology publication features information on materials needed to meet severe conditions such as extreme heat, abrasive action, corrosion, or problems beyond the capabilities of conventional materials. *Carborundum Co.*

Circle No. 299, Page 7-8

Lead-filled epoxy-casting material bulletin introduces new product. Maraset resin No. 341 is useful in fabricating radioactivity shielding containers and structures, and for applications as instrument housings and pipe and valve fittings. Provides instructions on proportions of resin and catalyst to be mixed for castings that set hard with brief room-temperature cure. *Marblette Corp.*

Circle No. 300, Page 7-8

Electric fork truck purchasers free comparison chart serves as a buying guide. Enables users to survey simultaneously—operation, design and maintenance characteristics of three different trucks by filling in appropriate categories. *Lewis-Shepard Products, Inc.*

Circle No. 301, Page 7-8

Nickel alloys—properties and uses—listed in abstract publications. Technical information on new materials, metals and alloys and their application to specific problems shown. *International Nickel Co.*

Circle No. 302, Page 7-8

Boron-containing ferro alloy known as grainal explained in 8-p technical catalog. Gives description of the alloy, use in steelmaking, properties, transformation characteristics, impact resistance, and standard hardenability charts. *Vanadium Corp. of America.*

Circle No. 303, Page 7-8

Flexible core blowers described in bulletin which carries specifications, photographs of seven models with capacities to 400 lb. Schematic drawing and specifications chart included. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

Circle No. 304, Page 7-8

Air pollution control and ventilation equipment brochure outlines particulars on multi-wash collectors; recirculating and settling tanks; dust, fume and smoke hoods; and ventilated workbenches. *Claude B. Schneible Co.*

Circle No. 313, Page 7-8

Birth of gray iron castings related in technical, colorful, 20-p book. Reviews essential role of gray iron in modern manufacturing. Relates production of gray iron castings into two basic raw materials, pig iron and foundry coke. *Pittsburgh Coke & Chemical Co.*

Circle No. 305, Page 7-8

free films

■ **Motion pictures and other visual aids based on foundry processes and supplies are also yours *for the asking.* These films are suggested for formal or informal training groups. The owners of films in this column will send booking request forms to MODERN CASTINGS readers who circle the appropriate number on the Reader Service card (page 7-8).**

The First Five Minutes, 27 min. film tells industrial fire brigade members of the four big responsibilities they have during the first five minutes of any fire. *National Board of Fire Underwriters' Film Library.*

Circle No. 306, Page 7-8

How Zinc Controls Corrosion, 16 mm sound and color film, 38 min. Mounted on 1600 ft reel. Shows fundamental nature of corrosion, methods of coating for protection, how "Sea Wolf", new atomic submarine, is protected by zinc anodes around her stern frame and keels. *Rothacker Inc.*

Circle No. 307, Page 7-8

Machining Stainless Steels, half-hour, 16 mm film depicts most important steps, and presents pertinent metallurgical and operating facts. Film made for Armco Steel Corp. *The Jam Handy Organization.*

Circle No. 308, Page 7-8

Shop Safety, 16mm, sound, b/w, 28 min film vividly portrays accidents, their causes and prevention, and safety rules which apply to arc and gas welding. *United World Films, Inc.*

Circle No. 309, Page 7-8

Air reduction, audio visual films available. Various applications of industrial gases, welding and cutting techniques, and equipment shown in motion pictures for companies, business groups, schools. Depicts latest developments in automatic welding. *Air Reduction Sales Co.*

Circle No. 310, Page 7-8

dietrich's corner

by h. f. dietrich

The Intinerant Foundryman

What caused the old timer to move from job to job like a humming bird flitting from flower to flower? Were the old timers in the foundry a dissatisfied gang of bums who moved everytime someone dropped the bottom? Or, was there some reason back of the wandering sand rat—some driving force that caused him to roll his tools in his apron every time a freight whistle blew?

The colonial foundryman moved his foundry as well as his tools. He served the domestic community by supplying firebacks, grates, and cooking utensils. Where settlements were scattered far and wide, it was easier to move his patterns and set up shop each time he found business than to take orders and deliver castings. He was an iron worker rather than a foundryman. Skill and ingenuity provided his livelihood. A fanatic love of freedom, thirst for adventure, and the shifting needs of small communities were the driving forces that caused him to travel.

With the advent of the factory system in the foundry industry, the itinerant foundryman was forced out of business. Improved transportation allowed him to ship castings for some distance, and foundries could supply the demand from a central point. Foundries grew larger and located at trade and rail centers.

It was an age of wanderers. Saddle tramps roamed the range, prospectors dug their gopher holes in the hills, wetbacks followed the railroads, and a tide of immigrants flooded the eastern labor market. Because industry was not held to seniority, the highly skilled molder could find work when his skill was in demand.

The wandering sand-rammer jockey had as much reason as anyone to ride the rods, or the tender, to the far horizon. Work was seasonal and uncertain, demands varied from town to town, and variable skills were required for short periods of time. No FBI cross-indexed everything that moved. If a man wanted to get lost, it wasn't impossible. The nomadic blood of his forebears was not entirely drained from the da Vinci of the shovel and riddle. He moved when and where fancy and necessity lead him.

Business waves seemed to travel from east to west—perhaps because of slow communication—and by following a wave west the itinerant molder could see a lot of country and still earn a living.

Good molders like good gun slingers were known by reputation. A favorite company method of reducing costs was to cut wages when times got tight.

The good molders, confident of their ability, would leave for greener fields. A good floor, pit, or bench man could find work in another community that was not in a business slump.

The great depression of the 30's threw the nomadic casting artist into a tailspin. No matter where he dropped off of a freight, he couldn't find work in a foundry. Seniority rules kept him from using his skill as an opening wedge in a job. As a result, many of these adaptable sand rats went into other fields, or just faded away.

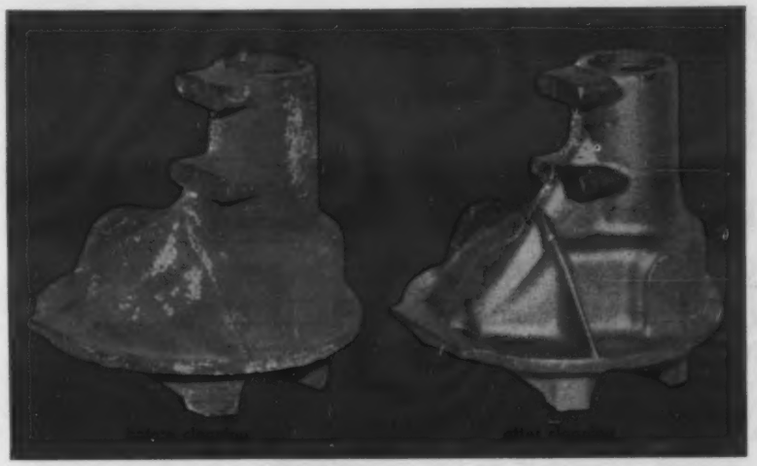
Far from being a wandering bum, the old timer was following a way of life of the times. To live, and see the country, he changed jobs and homes. When high skill no longer paid a premium, the itinerant molder who could handle any job faded from the picture.

Present day workers with improved transportation and more leisure time can follow their traveling instinct during vacation periods. They can zigzag the country during weekends, always working from one central point. They have not lost the desire to roam. *They work to travel—the old-timer traveled to work.*

WHEELABRATOR® STEEL SHOT

cuts abrasive costs for

ALL TYPES OF FOUNDRIES



Malleable Foundry Saves $12,000 Annually

Cuts Abrasive Consumption in half

Savings of $1,000.00 a month in abrasive cost are being made at Albion Malleable Iron Co., as a result of switching from a malleable type abrasive to Wheelabrator steel shot.

This high production foundry operates a battery of 8 Wheelabrator Tumblasts, cleaning a wide variety of castings. Consumption of the malleable shot in these machines was at the rate of 20 tons a month. Since changing to Wheelabrator Steel Shot this has been decreased to 110 tons a month, for an annual saving of $12,000.00 on abrasive alone.

More than 1200 firms have standardized on Wheelabrator Steel Shot and are recording inpressive savings. Consistently harder, with greater resistance to breakdown, it lasts longer in use, cleans better, and reduces total cleaning costs.

Write today for Bulletin 89-B — free — for detailed information on Wheelabrator Steel Shot

WHEELABRATOR
CORPORATION

630 South Byrkit Street **Mishawaka, Indiana**

Canadian Offices: Scarborough (Toronto) — Montreal

Circle No. 360, Page 7-B

THE RIGHT ALLOY FOR ANY FOUNDRY NEED

ELECTROMET offers a complete line of ladle and cupola addition agents

Additions of ferro-alloys will adjust the composition of the base iron to make it suitable for the particular work on hand. You can reduce chill in thin-sectioned castings or improve strength and machinability. You can, if desired, increase hardness and improve resistance to wear and heat-all through the simple addition of alloys. And there's an ever wide variety of ELECTROMET alloys to choose from.

ELECTROMET not only has the alloys to meet your needs, but also furnishes technical assistance in their most effective use. Please phone or write the ELECTROMET office nearest you for detailed information on these or other ELECTROMET products.

ELECTRO METALLURGICAL COMPANY, Division of Union Carbide Corporation, 30 E. 42nd Street, New York 17, N.Y. *In Canada:* Electro Metallurgical Company, Division of Union Carbide Canada Limited, Toronto.

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FERRO-ALLOYS AND METALS

UNION CARBIDE

ALLOYS FOR LADLE ADDITIONS

Ferrosilicons (50%, 75%, 85%, and 90%) In grades and sizes suitable for all conditions in the iron foundry. Silicon reduces chill in thin-section gray iron castings.

"SMZ" Alloy—A strong, super-graphitizing alloy and chill reducer. Contains zirconium and manganese to enhance the inoculating properties.

Calcium-Silicon—Inoculant for reduction of chill and for developing high-tensile strength. Especially suited for use in low carbon-equivalent irons.

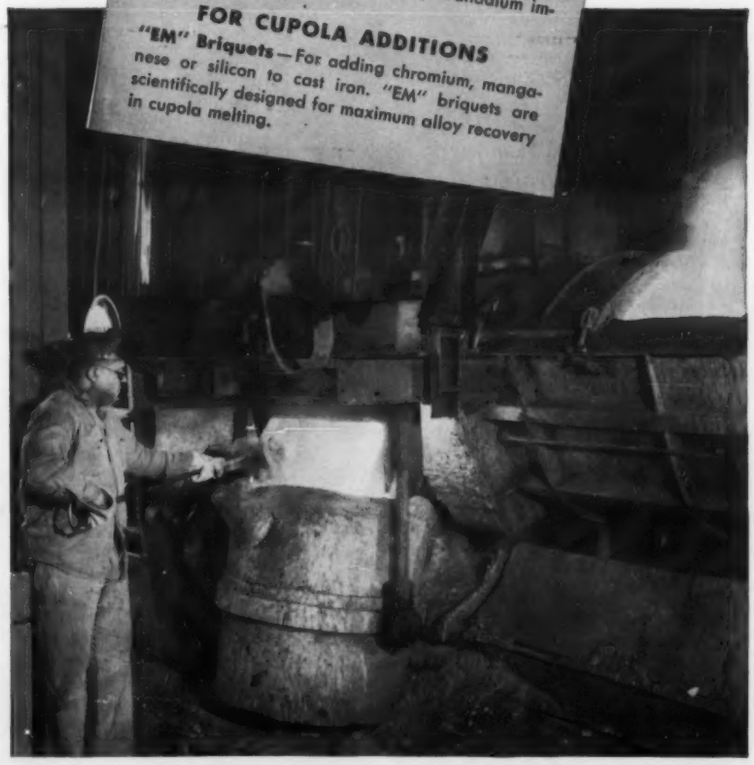
Zirconium Alloys (12 to 15% and 35 to 40%) Graphitizers for reducing chill, aiding machinability, and improving tensile properties.

Ferrochromium Alloys—Available in many grades for cast iron. All grades have rapid solubility. Widely used to improve the hardness, strength, and heat and wear resistance of cast iron.

Ferrovanadium—ELECTROMET foundry grade ferrovanadium has good solubility. Vanadium improves toughness.

FOR CUPOLA ADDITIONS

"EM" Briquets—For adding chromium, manganese or silicon to cast iron. "EM" briquets are scientifically designed for maximum alloy recovery in cupola melting.



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Circle No. 361, Page 7-8

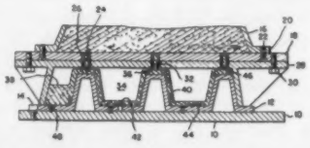
patent review

MELVIN NORD
Consultant in Law and Engineering

Shell Cores

A new method of producing blown shell cores uses the dryer to hold the core during curing while the pattern is in use to produce another core. A single core box may be used in conjunction with a number of dryers, and the core box is not subjected to the heat of a curing oven.

The core box (28) and its pattern (34) are mounted to the blow plate (18). The dryer (12) is contoured



to conform with the outline of the pattern. A core (40) is produced with a wall thickness representing the distance between the pattern and the dryer.

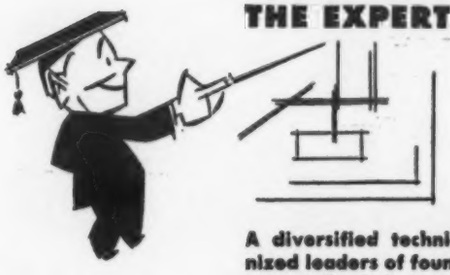
During curing, the core is support- on the dryer. *Pat. No.* 2,789,331 *issued April* 23, 1957 *to Harry W. Dietert and assigned to Harry W. Dietert Co.*

Clear Water

The clarification of the inky-black waters originating from foundry dust collectors, wet methods, and such operations as sand cleaning, sand blasting, and hydraulic cleaning of castings is possible.

These foundry waste waters are clarified by flotation with anionic collectors, either in the presence or absence of glue and related substances, —or the waters may first be settled with or without settling agents in combination with the flotation mentioned above. *Pat. No.* 2,784,486, *issued March* 12, 1957 *to Robert B. Booth and John M. Dobson and assigned to American Cyanamid Co.*

LISTEN TO THE EXPERTS



A diversified technical program, featuring recognized leaders of foundry thought and technique, will cover all of the newest developments in the production and processing of cast products. Be on hand to "STOCKPILE" your share of technical-practical foundry knowledge!

AFS Be sure you're there—Cleveland, May 19-23!

FOUNDRY SHOW & CASTINGS CONGRESS

WHICH IS BETTER?

It's easier to select equipment, materials or special services, when you can compare at close range. The AFS FOUNDRY SHOW and CASTINGS CONGRESS permits "on the spot" comparisons and choice of the one best suited to your individual requirements.

Be sure you're there AFS Cleveland, May 19-23!

FOUNDRY SHOW & CASTINGS CONGRESS

CO

AFS ADVANCE REGISTRATION CARD (1958)

• TYPE OR PRINT CLEARLY

NAME .....

POSITION .....

COMPANY .....

DIVISION (If any) .....

*CO. STREET ADDRESS .....

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Is your plant using equipment, materials and supplies that are suited to your operation? Are you fully informed on the latest models . . . the newest developments . . . the latest techniques? The AFS FOUNDRY SHOW and CASTINGS CONGRESS will make it possible for you to *try out* the hundreds of new and improved products that will be on display at the *point of foundry sales!*

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Circle No. 362, Page 7-8

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Circle No. 363, Page 7-8

Automatic Metering Means Better Magnesium Castings

BY F. C. BENNETT
Chief Die Casting Section
Metallurgical Laboratory
Dow Chemical Co., Midland, Mich.

■ An automatic metering system for supplying molten magnesium alloy to cold chamber die-casting machines has demonstrated production rates equal to those achieved by hot chamber zinc or magnesium machines without some of their limitations. The process is simple, flexible in operation, continuous, safe, easy to run, and produces good castings.

As stated in a paper presented at the 13th Annual Convention of the Magnesium Association, Dow engineers realized that a good automatic metering system should do everything in sequence after the die closure button initiated the cycle, except remove the casting.

Operation

With the Dow system, the operator presses a button, the die closes, the metering valve opens and closes to discharge the proper amount of molten metal into the shot cylinder, the injection stroke is made, and the die-holding period is followed by opening and part ejection. The operator then removes the casting.

In laboratory tests of the metering system, a small part cast with a shot weight of 0.3 lb was regularly produced at 330 cycles per hour with little effort by the operator. This led to production runs on a convertible die which could be used on either a hot or cold chamber machine. Well known manufacturers using magnesium metering equipment report the ability of the die to remove heat determines the peak production rate.

Advantages

The metering system is safer than manual ladling because the operator stands behind the parting line during the cycle. The bursting hazard as the die opens is minimized because the operator can regulate the thickness of the cast "biscuit" at the end of the shot piston.

The cold chamber metering system is flexible. In plants where magnesium and aluminum must be processed on the same machines, the feed unit can be moved back to permit hand ladling of aluminum or aluminum ladling can temporarily replace it.

The system is well suited to large parts such as transmission housings and engine blocks, where hand ladling is very difficult and might otherwise require two men.

ONE OF THE LARGEST EVER BUILT...

DIMENSIONS
90" x 103"
Cope 42"
Drag 36"

by American . . . OF COURSE

A division of Cromb & Gagel, Inc.

Specially designed for a large eastern foundry, this heavy duty flask is one example of the close cooperation between our experienced engineering department and our customer-foundry.

The heavy duty flask shown above has ½" walls, special heavy bearings and reinforcements and lifting loops and brackets. Cutouts for core installations are heavily reinforced.

We'll be glad to place our flask engineering and designing experience at your complete disposal and make quotations on your flask requirements.

Send today for our 1958, 24 page Catalog G

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Circle No. 364, Page 7-8

Produce More
Top Quality
Castings
with
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FOUNDRY MATERIALS

Use these Time-Tested Products for Best Results

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Century Molding
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Circle No. 365, Page 7-8

Co-Insurance

continued from page 34

some very evasive. Maybe it's because they don't really know or else they don't want to know. But as a buyer of insurance, it is your business to know and to be able to let them know that you know exactly what is meant.

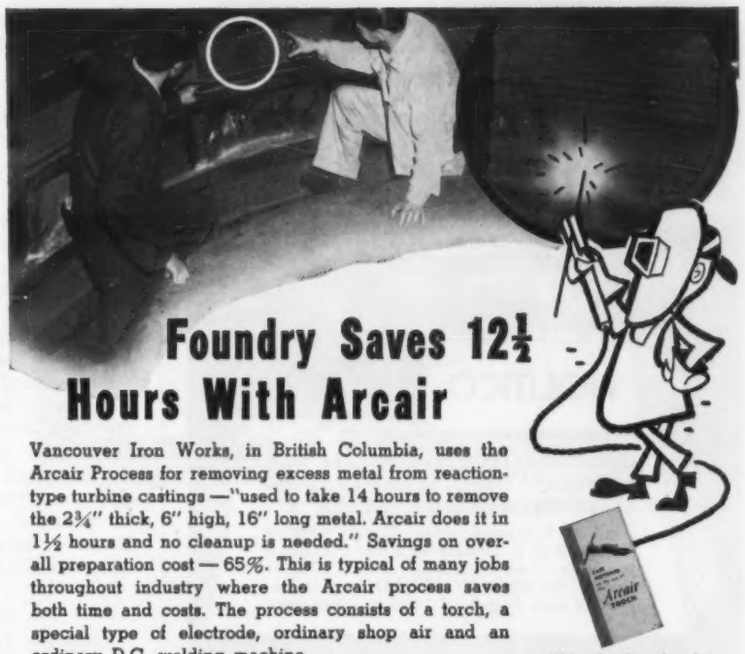
Because of court decisions, most insurance men would insist they are not evasive on the worth of a building. To protect their clients, they would say, if pressed, that the worth should be ascertained by a qualified appraisal firm. Agents expect the insured to pay for this expensive procedure. Yet they will not agree to abide by the appraised amount; and reserve their right to dispute the appraisal later in court.

Property Value

The court decided cases, in general, take the view that the actual insured value is the value the insurance policy talks about. Now the actual value is the market value, and that means about the same to you in real property as it does when you talk about the market value of pig iron or scrap. When you want to know their market value, you consult prices listed in a current publication to learn what is being paid at the various established markets.

However, there is no publication that can state with accuracy and clarity the market value of your insured premises at the time a fire might burn it down to the ground, or that might only partially damage it. The value, therefore, is something over which there can be great disagreement. The argument may be one which would and does often get into court. Thus, a co-insurance rated insurance policy is apt to be a potential lawsuit. You are buying a fuss and an argument over the settlement. You are matching wits with experts, the insurance company's adjustors and lawyers who know every twist and turn and angle in the business.

Even worse than this, when you buy co-insurance, you are buying a pig in a poke. Because, if it should be decided that you did not carry the per cent of co-insurance agreed to, you will be penalized. In such a case you can get only the per cent of your claim that you did



Foundry Saves 12½ Hours With Arcair

Vancouver Iron Works, in British Columbia, uses the Arcair Process for removing excess metal from reaction-type turbine castings —"used to take 14 hours to remove the 2¾" thick, 6" high, 16" long metal. Arcair does it in 1½ hours and no cleanup is needed." Savings on overall preparation cost — 65%. This is typical of many jobs throughout industry where the Arcair process saves both time and costs. The process consists of a torch, a special type of electrode, ordinary shop air and an ordinary D.C. welding machine.

Write Arcair today for this new case history booklet.

Arcair Metal Removal Torches
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Circle No. 366, Page 7-8

FORWARD DUMP BARROWS for FOUNDRIES

No. 102-A Barrow. Single steel wheel with 2" face, 16" diameter and 12 spokes.

Here are two well-balanced charging Wheelbarrows for heavy duty foundry service. Handle loads up to 1000 lbs. Sturdy, welded, all-steel construction. Single wheel or double wheel. Available with zero pressure cushion type wheels or 4 ply pneumatic tired wheels with roller bearings. Immediate shipment.

Write for Circular No. 58.

No. 113-A Barrow. Two steel wheels with 2" face, 18" diameter and 10 spokes.

Sterling FOUNDRY EQUIPMENT
At Your Service!
STERLING WHEELBARROW COMPANY - MILWAUKEE 14, WIS., U.S.A.

Circle No. 367, Page 7-8

PRODUCTS

Over 40 silicates (liquids, solids, hydrated and anhydrous powders). You get the right one for your particular process.

USES

Sealants for porous castings, binders for cements, detergents for metal cleaning, coagulant aid for water treatment.

SERVICE

From nine plants, Anderson, Ind.; Baltimore, Md.; Buffalo, N.Y.; Chester, Pa.; Jeffersonville, Ind.; Kansas City, Kansas; Rahway, N.J.; St. Louis, Mo.; Utica, Ill. Distributors in over 65 cities.

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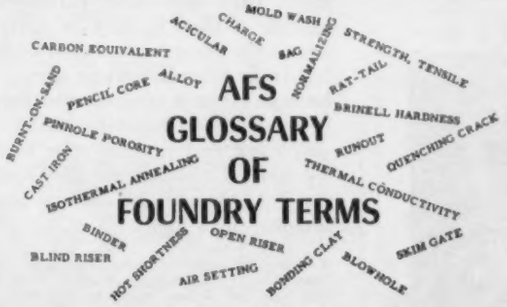
Circle No. 368, Page 7-8



Including almost 2000 terms, this book is intended to help standardize the meanings of foundry terms throughout the metal castings industry. In its preparation, reference was made to many presently existing glossaries and dictionaries of scientific and engineering terms. IT IS THE MOST COMPLETE WORK OF ITS KIND and should be at the finger-tips of every member of the metal castings industry. (80 pp. 6 x 9 Paper Bound.)

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Circle No. 369, Page 7-8

carry. This is the worst feature of all in buying co-insurance. Suppose that your $100,000 building was proven by the insurer to be worth $200,000. Then you were only 50 per cent insured instead of 80 per cent. In such a case as this, if you had a partial loss and claim of $10,000, you would receive only a $5,000 settlement (50 per cent) instead of a full $10,000 settlement.

If you buy 80 per cent co-insurance, you are agreeing to accept a settlement of 80 per cent of the damages, in the event of a total loss, and to insure yourself for the remaining 20 per cent. Thus, if you should be discovered to be carrying only half the required amount of insurance, the company will point to the pro-rata distribution clause also written in the policies, and then will advise you that you are entitled to the smaller amount of money because of the language in the fine print. In foundry buildings, partial losses are more normal and therefore the chief concern.

If you want to make iron with a certain silicon analysis you buy pig iron with a definite known analysis. You weigh and measure carefully everything that goes into your furnace. You allow the necessary number of points for oxidation of silicon and in general scientifically compute exactly what to expect. The insurance company does, too. Instead of metallurgists, they employ actuaries. These people know exactly how much the insurance companies can expect to save each year by selling co-insurance instead of straight insurance.

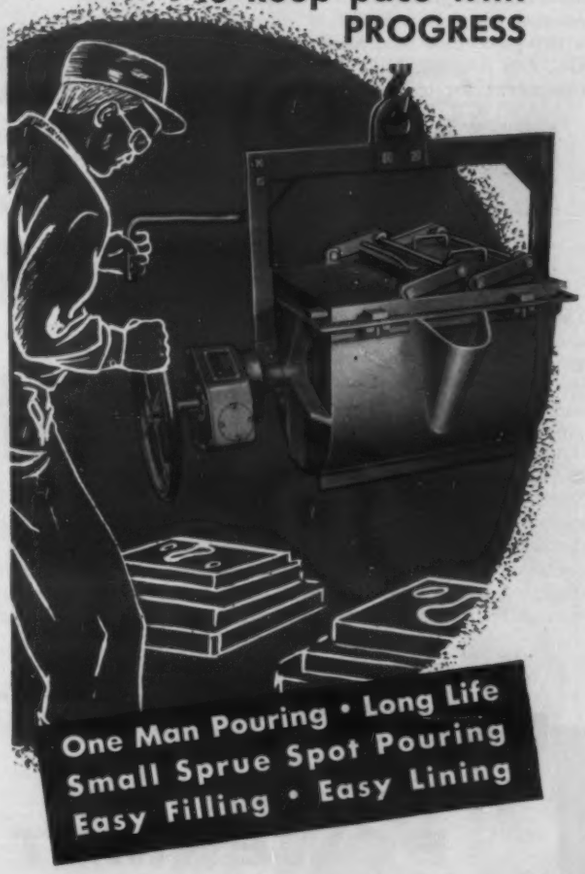
Straight Insurance

Many agents will refuse to sell you straight insurance. Maybe many companies are unwilling to write it, but there are agents who will and companies that will.

If you buy straight insurance on that foundry building of yours which you think is worth $100,000, you don't need to worry about the insurer making a $200,000 building out of it at a later date when damaged. You can buy $50,000 or $100,000 insurance on it or whatever you want to buy, providing the insurance company will carry it for that sum. The rate will be set by the rating bureau as provided by

Continued on page 104

JOB ENGINEERED
to keep pace with PROGRESS



One of America's largest manufacturers requested a ladle capable of fast, economical spot pouring of shell molds. This special ladle was Industrial's Job Engineered solution to this foundry problem.

For high speed production line pouring, you can lower labor costs . . . reduce rejects . . . protect flasks and conveyors from spillage . . . and increase production with production-planned foundry equipment by Industrial.

For nearly half a century, Industrial has contributed to Foundry Progress by offering constantly improved pouring and handling equipment featuring forward-looking designs.

Let Industrial help you solve your pouring problems. Write today for latest catalog.

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EQUIPMENT COMPANY
271 OHIO ST., MINSTER, OHIO

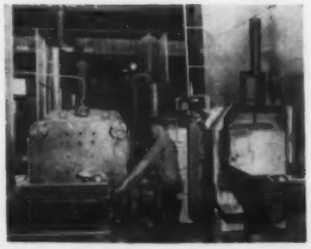
Circle No. 370, Page 7-8

here's how

■ Here's how a foreign automobile manufacturer produces a combination exhaust and intake manifold core in a two-piece core box. **Shell Products Co.**, Los Angeles, built the core box equipment for overseas customer of

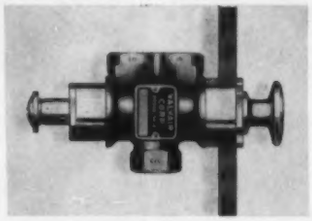
Shallway International Corp. Hollow shell cores for two-cylinder auto engine will be produced at rate of 70 per hour with this equipment that uses neither loose pieces nor ejector pins.

■ Here's how **Madison-Kipp Corp.**, Madison, Wis., teams an aluminum melting furnace and a high speed die casting machine for efficient production and minimum worker fatigue. Charging has been simplified by convenient loading platform and an air-



operated door. Side dipout is located at working height, close to the machine, and radiation from the molten metal is kept to a minimum.

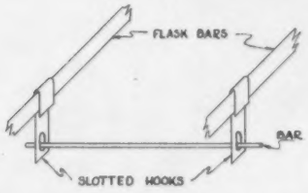
■ Here's how **Valvair Corp.**, Akron, Ohio, meets military need for knob-controlled, panel-mounted valves for



up to 200 psi service. Valvair foundry uses the precision casting method to produce a one-piece bronze body.

■ Production costs have been reduced and casting shipments speeded through a system of bars and supports developed by **Zenith Foundry Co.**, Milwaukee. These are used in place of the customary flask bars.

Supports are made from scrap steel and shaped as shown in the sketch and may be prepared in an assortment of lengths to position round bars at



various levels in the cope. To rig a flask, hang the supports over the existing flask bars placed high in the cope and insert the desired number of concrete reinforcing rods or other round bars.

On a job which formerly required a day and a half of cutting, welding and bolting to prepare, the flask was set up in 15 minutes using the slotted hooks and bars. Shakeout too is easier with the loose hook and bar system. Al Roskom, slinger molding foreman.

Co-Insurance

Continued from page 103

the laws of your state and acceptable to the state department of insurance. If you don't like the rate set, you have the right to a hearing and, if necessary, you have resort to the courts and may appeal the decisions. Even if the rate was $2.50 per hundred instead of $2.00, what of it? $50,000 worth of insurance may be enough to carry on the building. If that is all you carry, your premium would be $1,250 instead of $1,600. And look at all of the worries eliminated. Maybe a $100,000 building wouldn't be replaced as such. Chances are it's probably nearly obsolete anyway.

You might find another building just as good somewhere else for $50,000 that would be good enough to take its place. You might have the sort of building that just couldn't burn down completely and the only thing you fear is partial damage. As long as you carry the minimum insurance to cover partial damage, that would be enough as far as you are concerned. You may find that the insurance company would want you to carry more than just that minimum amount. Offer to buy a certain amount of insurance on your building from your insurance agent. If he won't get a company to carry it, try another insurance agent. If you can't find one in your town, try another town. Someplace along the line you will be able to compromise on a figure.

■ By way of acknowledgement, I want to thank Harry Fife of Fife Agency, Canton, Ohio, for help with this article, and who has been of considerable assistance in my own efforts to obtain straight insurance. I further feel that the candid and friendly advice of Dan Tanner of The American Central Insurance Company was too unusual to allow his name to pass without mention.

■ To obtain single additional copies of this article, circle C, Reader Service Card, pages 7-8.

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Circle No. 373, Page 7-8

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SAND TECHNOLOGIST West Coast leading supply house has opening for young man to learn sand technology from established expert and take charge of fully equipped service sand laboratory. First class opportunity for advancement. **Box E-6, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

WANTED: Manager for Grey Iron Foundry, West Toronto, producing mostly captive work—applicant besides foundry experience must have estimating and sales experience for quoting outside jobs. Apply by letter, quoting experience to:

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MELTING FOREMAN Experienced in cupola, and electric furnace melting, and refractories. Large productive gray iron foundry located middlewest. Good opportunity for right man. **Box E-7, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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GRAY IRON FOUNDRYMAN, 7 years experience in supervision of labor, shakeout, pouring, and melting in two production shops. Seeking similar position. **Box E-9, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

SUPERINTENDENT OR MANAGER General foundry foreman now operating a captive high alloy steel, carbon steel, gray iron and non-ferrous foundry for large mining company. Graduate metallurgist; age 38, familiar with cupola, electric furnace, acid and basic processes, sand slinger, floor, pit, and squeezer experience. Jobbing and production experience. Available March 1st. **Box E-10, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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Odd Bits
WHEN A BUDDHIST OF OLD—TIME BURMA PAID TO HAVE A LARGE BRONZE BELL CAST TO GIVE TO A PAGODA, A RECORD OF HIS NAME, WORKS OF CHARITY AND HIS HOPES FOR REWARD HEREAFTER WAS CHISELED IN THE BELL'S SURFACE.

BETTER CORES FOR LESS MONEY

SUPERMIX

- Cuts mixing time 50%
- Minimizes air hardening
- No heating
- No crushing
- No balling
- Mixes all binders

Write today for complete details

UNITED STATES FORGE AND FOUNDRY CO.
Pulaski, New York

Circle No. 372, Page 7-8

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at what May 19-23 Offers You!

. . . then, you'll see why EVERY Progressive Foundryman will be in Cleveland for the 1958 AFS FOUNDRY SHOW combined with the AFS CASTINGS CONGRESS.

WHICH IS BETTER?

It's easier to select equipment, materials or special services, when you can compare at close range. The AFS FOUNDRY SHOW and CASTINGS CONGRESS permits "on the spot" comparisons and choice of *the one best* suited to your individual requirements.

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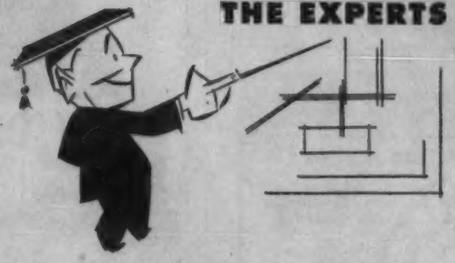
Is your plant using equipment, materials and supplies that are suited to your operation? Are you fully informed on the latest models . . . the newest developments . . . the latest techniques? The AFS FOUNDRY SHOW and CASTINGS CONGRESS will make it possible for you to *try out* the hundreds of new and improved products that will be on display at *the point of foundry sales!*

LISTEN TO THE EXPERTS



A diversified technical program, featuring recognized leaders of foundry thought and technique, will cover all of the newest developments in the production and processing of cast products. Be on hand to "STOCKPILE" your share of technical-practical foundry knowledge!

DO IT THIS WAY!

There's always a way to "do it better" . . . come to Cleveland, May 19-23, and talk over your problems with scores of technicians and engineers on duty throughout Foundry Week. They'll demonstrate their equipment for you . . . help you reduce the work load . . . be more efficient. What's more, they'll all be there, *under one roof*, waiting to welcome and serve you.

MARK YOUR CALENDAR MAKE YOUR RESERVATIONS

✓ EVERY foundry company will benefit by being represented.

✓ EVERY foundryman will take an added value by being there!

AFS

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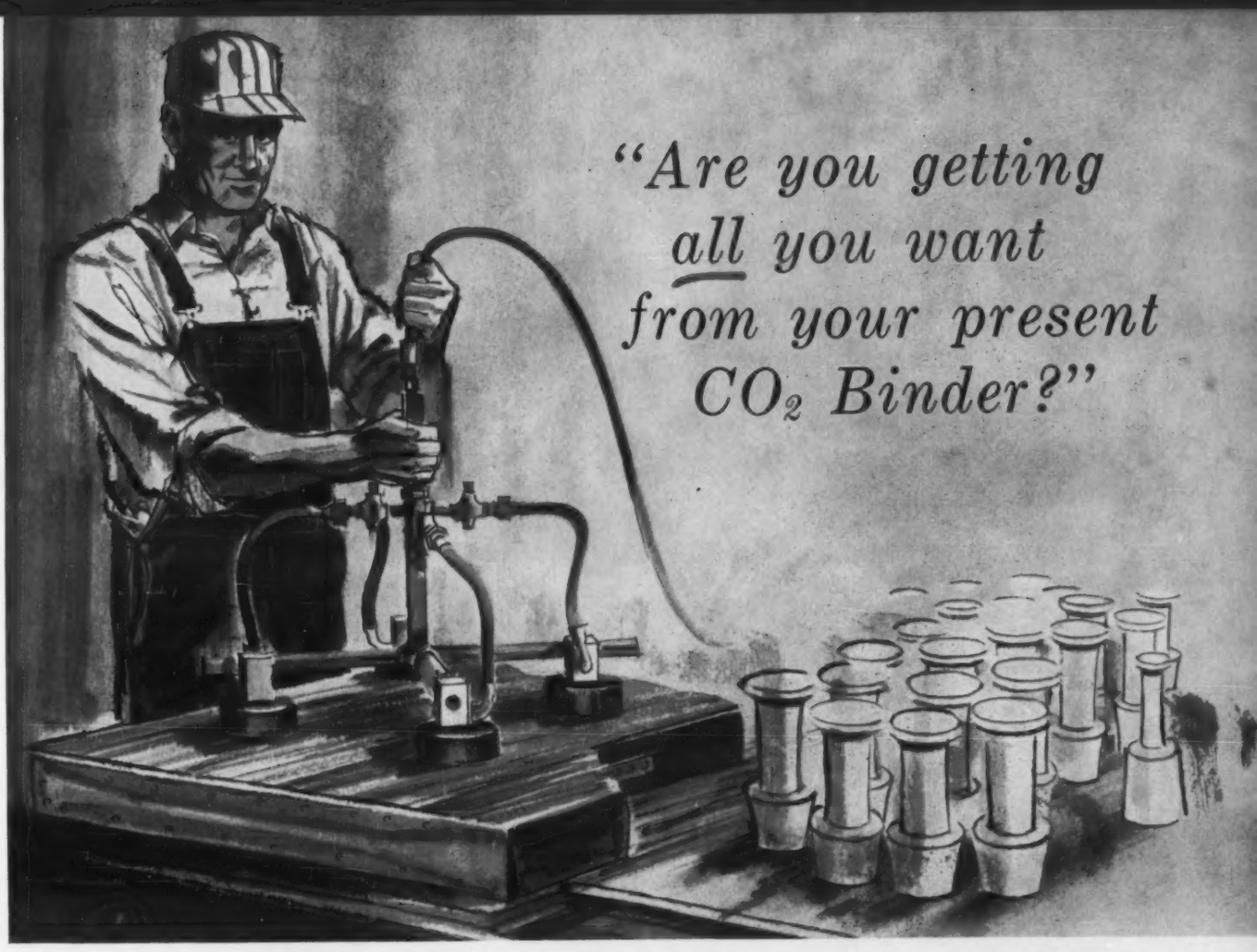
National Clinic Features Castings Cost Reduction

■ The major metalworking areas throughout the country will host a new cost reduction training clinic in 1958 sponsored by the consulting firm, Metallurgical Associates, Inc., New York. The series of one-day working sessions, *"Getting The Most For Your Casting Dollar,"* designed to help the metalworking industry reduce material costs, will commence Feb. 11 at the Sheraton Hotel, Philadelphia.

Buyers and engineers who attend the clinic will receive expert instruction under the supervision of Howard F. Taylor, Massachusetts Institute of Technology. Subjects include metallurgy, design, physical properties, and cast processes for gray iron, steel, malleable, ductile, aluminum, brass, bronze, and other non-ferrous castings.

Harold Brown, vice-president of the firm and director of the clinic, will limit classes to a size permitting audience participation in discussions of shop problems after presentation of each subject.

Circle No. 375, Page 7-8



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Stevens Steveco$_2$ CO_2 Binder gives you—

1. **The lowest viscosity**
2. **The fastest gas action**
3. **The fastest mixing with sand**
4. **The best sand flowability**

and many more advantages!

For a faster sand mix, with a more complete coating of sand grains, Stevens Steveco$_2$ is the choice every time. The better sand flowability means it will pack or blow to maximum density giving smoother surfaces to cores and molds. You need *less* Stevens Steveco$_2$ Binder for the *same* strength and it affords better collapsibility.

With all these plus advantages, you *also* get a minimum of grain shedding, a longer bench life of the sand, longer shelf life for cores and molds and high scratch hardness! Good reasons why you should ask your local Stevens Sales Representative for a demonstration in your foundry now! Call or write today, and start getting *all you want* . . . from Stevens Steveco$_2$ Binder!

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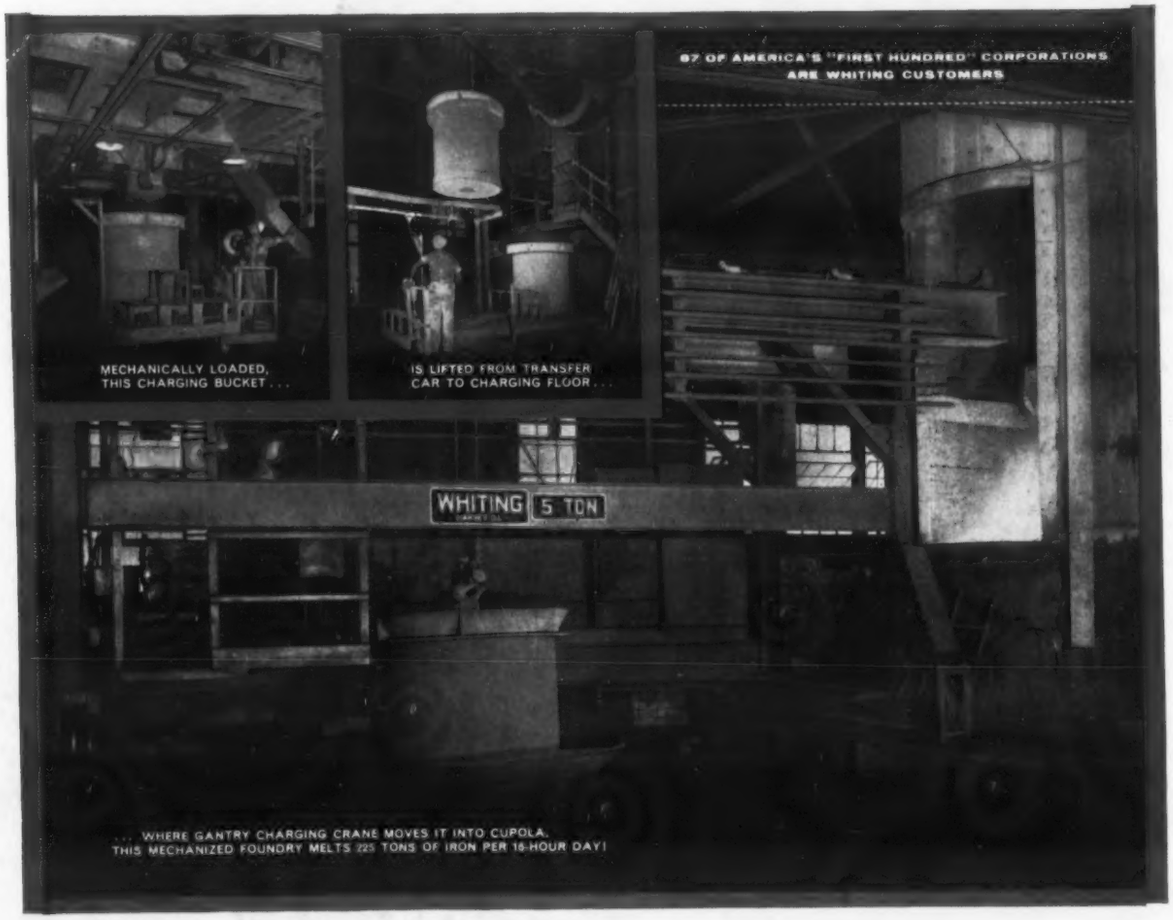
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IS LIFTED FROM TRANSFER CAR TO CHARGING FLOOR . . .
87 OF AMERICA'S "FIRST HUNDRED" CORPORATIONS ARE WHITING CUSTOMERS
WHITING 5 TON
. . . WHERE GANTRY CHARGING CRANE MOVES IT INTO CUPOLA. THIS MECHANIZED FOUNDRY MELTS 225 TONS OF IRON PER 16-HOUR DAY!

At American Standard... Charging time cut one-third!

New mechanization at American Radiator and Standard Sanitary Corporation, Baltimore, has resulted in an immediate ⅓ reduction in charging time! Here, in a refurbished foundry, Machine Age speed is accompanied by economy and reliability. A Whiting Yard Crane now unloads scrap metal . . . and Whiting Cupolas, Ladles, Weigh Hoppers and a Gantry Charging Crane team up to produce more, and produce it faster. Practical allocation of manpower helps American-Standard pare its over-all production costs even more!

Learn about the advantages gained when you use foundry equipment designed for your needs. Write for the Booklet, "Whiting Foundry Equipment." Whiting Corporation, 15628 Lathrop Avenue, Harvey, Illinois.

WHITING FOUNDRY EQUIPMENT

MANUFACTURERS OF CRANES; TRAMBEAM HANDLING SYSTEMS; TRACKMOBILES; FOUNDRY, RAILROAD AND CHEMICAL PROCESSING EQUIPMENT

modern castings

Circle No. 376, Page 7-8